

Appendix K. Train Operations

- HST Phase 1 Service Plan
- Caltrain Operations Schedule
- Concept Level Operations Analysis for San Francisco Terminal

California High-Speed Train Project



TECHNICAL MEMORANDUM

Phase 1 Service Plan
TM 4.2

Prepared by: Signed document on file
FOR Foster Nichols

20 Nov 08
Date

Checked by: Signed document on file
Paul Mosier, O&M Manager

20 Nov 08
Date


Approved by: Signed document on file
Ken Jong, Engineering Manager

21 Nov 08
Date

Released by: Signed document on file
Tony Daniels, Program Director

22 Nov 08
Date

Revision	Date	Description
0	20 Nov 08	Initial Release

Prepared by 

for the California High-Speed Rail Authority

This document has been prepared by **Parsons Brinckerhoff** for the California High-Speed Rail Authority and for application to the California High-Speed Train Project. Any use of this document for purposes other than this Project, or the specific portion of the Project stated in the document, shall be at the sole risk of the user, and without liability to PB for any losses or injuries arising for such use.

TABLE OF CONTENTS

1. INTRODUCTION.....	3
2. ANALYTIC METHODOLOGY.....	3
3. ASSUMPTIONS AND GENERAL PRINCIPLES.....	4
4. PHASE 1 SERVICE PLAN.....	6
STOPPING PATTERNS AND SERVICE FREQUENCIES	6
TRAIN SCHEDULE DEVELOPMENT	9
ESTIMATED PASSENGER LOADS AND LOAD FACTORS	11
5. FLEET REQUIREMENTS	17
EQUIPMENT CYCLES	17
REVENUE TRAINSETS.....	17
6. TRAIN STORAGE REQUIREMENTS.....	18
APPENDICES – PHASE 1 SERVICE PLAN CHARACTERISTICS.....	20
[A] BASE, WITH 7.0% RECOVERY TIME ALLOWANCE	20
A1. Hypothetical Timetable	22
A2. Stringline Diagrams.....	27
A3. Equipment Cycles	32
[B] – VARIATION, WITH 1.0-3.5% RECOVERY TIME ALLOWANCE	39
B1. Hypothetical Timetable	44
B2. Stringline Diagrams.....	49

FIGURES

FIGURE 1 – ESTIMATED PASSENGER LOADS IN 2030 – EVENING PEAK HOUR SOUTHBOUND	12
FIGURE 2 – ESTIMATED PASSENGER LOADS IN 2030 – EVENING PEAK SHOULDER HOUR SOUTHBOUND	13
FIGURE 3 – ESTIMATED PASSENGER LOADS IN 2030 – EVENING PEAK HOUR NORTHBOUND.....	14
FIGURE 4 – ESTIMATED PASSENGER LOADS IN 2030 – EVENING PEAK SHOULDER HOUR NORTHBOUND.....	15
FIGURE 5 – ESTIMATED PASSENGER LOADS IN 2030 – AVERAGE OFF-PEAK.....	16

TABLES

TABLE 1 – INTERMEDIATE STATION DWELL TIMES	5
TABLE 2 – TERMINAL STATION MINIMUM LAYOVER TIMES	5
TABLE 3 – TRAIN STOPPING PATTERNS	6
TABLE 4 – MINIMUM TRIP TIMES BETWEEN SELECTED STATIONS	7
TABLE 5 – PEAK AND OFF-PEAK SERVICE FREQUENCIES	8
TABLE 6 – REVENUE TRAINS BY TIME PERIOD AND TRAIN TYPE	10
TABLE 7 – DAILY AND ANNUAL TRAIN-MILES	10
TABLE 8 – ESTIMATED DAILY STATION-TO-STATION RIDERSHIP IN 2030 (PHASE I)	11
TABLE 9 – RIDERSHIP PEAKING FACTORS	11
TABLE 10 – 200M TRAIN SECTIONS NEEDED TO “FILL OUT” 400M TRAINS	17
TABLE 11 – OVERNIGHT TRAIN STORAGE REQUIREMENTS	18
TABLE 12 – MID-DAY TRAIN STORAGE REQUIREMENTS.....	19

PHASE 1 SERVICE PLAN

1. INTRODUCTION

A concept level service plan and hypothetical timetable for the Phase 1 California High Speed Train (HST) project has been developed, which provides a description of the proposed type and quantity of service that is more detailed than had been available previously. The Phase 1 service plan is intended to serve several purposes:

- Confirm the level of service assumptions (travel times and service frequencies between station pairs) used to develop the estimates of system ridership and revenue
- Validate the operational feasibility of the desired level of service at a conceptual level
- Identify operable patterns of train service, particularly the general requirements for non-stop or limited-stop trains to pass slower trains that need to make a greater number of stops along the route (i.e., the locations and frequencies of occurrence of these “overtakes” at various times of day)
- Provide a basis for estimating the number of required train sets and overall rolling stock fleet requirements
- Provide a basis for estimating platform track and storage track capacity needed to support operations at the end terminal stations

2. ANALYTIC METHODOLOGY

A PB-developed spreadsheet-based “static” model for formulating and analyzing concept level operating plans for railroad systems was adapted for the HST network. This model utilizes train performance calculations taken from prior detailed “dynamic” simulation modeling results to identify the running time characteristics of the various types of service and train stopping patterns that are expected to operate on the HST system. The model generates stringline (time-distance) diagrams and tabular outputs describing the timing and scheduled operating performance of every train. It provides a level of detail sufficient to confidently perform “pattern analysis” of the various express, limited stop and all-stop local services that are envisioned, with the objective of identifying a reasonable service pattern that achieves the desired level of service at each station while minimizing both conflicts between trains and the required number of overtakes.

The spreadsheet model provides the ability for trains to be “linked” with subsequent trains and assigned to specific train sets. The resulting train set equipment cycles form the basis for estimating the size of the required rolling stock fleet.

The model also includes a module that compares the forecast level of system ridership with the quantity of service delivered, allocating riders to specific trains and calculating estimated load factors (projected number of riders per train divided by train seating capacity), using station specific boarding and alighting passenger (detail) estimates and peaking factors derived from the ridership forecasts.

This plan, while contributing to confident approximations at the conceptual level, does not yet represent a detailed operating plan for the system, even though the train timetables and stringline (time-distance) diagrams give the impression of a high level of precision. This conceptual plan

analysis is based on optimal ideal operations with trains running exactly on schedule. It does not analyze any randomization, delays or perturbations to the normal schedule and does not address the time required to recover from track blockages or the impacts of delay conditions on the network. A full detailed operating plan supported by dynamic computer simulation modeling of train movements throughout the system will be developed in a subsequent task later in the project, at which time an actual proposed timetable can be confidently prepared and approved.

3. ASSUMPTIONS AND GENERAL PRINCIPLES

The following assumptions and general principals guided the development of the Phase 1 service plan:

1. The HST system assumed to operate independently of any other passenger or freight rail services
2. Train sets are assumed to comprise units of 200 meters (m) in length, either singly (200 m train with 500 passengers) or operating as pairs (400 m train with 1,000 passengers)
3. Train running times were obtained from simulated train performance calculations, with an additional time factor added to these times. This added time, sometimes referred to as “schedule pad” or “recovery time” accounts for operator performance, external conditions and minor delays, which result in minimal day-to-day fluctuations in train performance – the additional time factor assumed in this analysis is common in passenger train scheduling, permits trains to recover from time lost due to minor causes, and provides an allowance for the system to maintain a high degree of overall on-time performance when operations are normal. Two different scenarios were analyzed concerning recovery time. The initial base case analysis assmed a recovery time factor of seven percent on top of the minimum train run time. This is consistent with current industry practice in the U.S. and is considered a conservative estimate, since the HST system is expected to operate at a higher level of precision than is “typical.” A second service plan variation was developed assuming a recovery time factor of three and one-half percent for most trains. In this second case, certain “premium” services, such as express trains during peak periods were assumed to operate with a recovery time allowance of as little as one percent.
4. The schedule features “clockface” service patterns and regular intervals between trains (headways), which can be easily remembered and is markedly customer friendly
5. The schedule features service patterns that repeat every hour, as opposed to patterns that differ somewhat from hour-to-hour providing for more simplified operations – this makes the service more regular and predictable and reduces the number of different types of overtakes required
6. The minimum spacing between trains following each other past a given point is set at three minutes, based on the assumed practical capacity design attributes of the signal and train control system
7. Express trains are given the highest priority in terms of their schedule paths; limited stop trains and those that travel a longer distance along the network have the next highest priority, and all-stop local trains generally have the lowest priority and, therefore, the highest incidence of overtakes
8. Train overtakes were arranged to utilize station (siding) tracks for express trains to pass local trains making a service stop, while maintaining consistency and reliability in the service stopping patterns.

9. The level of service between Los Angeles and Anaheim is maintained at four trains per hour per direction in the business travel peaks, and three trains per hour per direction at other times of day
10. The service levels and patterns developed as the basis for the ridership and revenue forecasts were taken as a guideline in the development of the Phase 1 service plan; adjustments were made where necessary to improve the operational efficiency and performance of the system; in all cases the level of service provided at each station remains at or better than the level assumed in the ridership forecasts.

The analysis assumed the following station dwell times and minimum terminal layover (turnaround) times. The latter is defined to be the minimum time allowed between the scheduled arrival of a train set at a terminal and the scheduled departure of the same train set in the opposite direction of service.

TABLE 1 – INTERMEDIATE STATION DWELL TIMES

Code	Station	Scheduled Dwell Time (mins)
SFO	Millbrae	1.5
RWC	Redwood City	1.5
SJC	San Jose	2.0
GLY	Gilroy	1.5
FNO	Fresno	1.5
BFD	Bakersfield	1.5
PMD	Palmdale	1.5
SYL	Sylmar	1.5
BUR	Burbank	1.5
LAU	L.A. Union Sta.	2.0
NSF	Norwalk	1.5

TABLE 2 – TERMINAL STATION MINIMUM LAYOVER TIMES

Code	Station	Minimum Scheduled Layover Time (mins)
SFT	S.F.-Transbay	30
LAU	L.A. Union Sta.	40
ANA	Anaheim	40
MCD	Merced	40

4. PHASE 1 SERVICE PLAN

STOPPING PATTERNS AND SERVICE FREQUENCIES

Table 3 depicts the various train types and stopping patterns that were used to formulate the Phase 1 service plan, along with the average total estimated travel time from the origin station to the final destination station. The “Express” train type makes only one intermediate stop between San Francisco and Los Angeles – at San Jose – and therefore provides the fastest run time between these points and with an assumption of one percent recovery time during the peak period, is estimated to run between San Francisco and Los Angeles in two hours-forty minutes. At the other end of the spectrum are “All Stop” trains that serve every station along the line and therefore take significantly longer to make a run between San Francisco and the Los Angeles basin.

TABLE 3 – TRAIN STOPPING PATTERNS

STOPPING PATTERNS																End-to-End	
Southbound																Run Time	
Train Type/Pattern	SFT	SFO	RWC	SJC	GLY	MCD	FNO	BFD	PMD	SYL	BUR	LAU	NSF	ANA		(mins)	
1 Bay Area Limited	X		X	X	X							X	X	X		205	
2 Express	X			X								X	X	X		194	
4 All-Stop	X	X	X	X	X		X	X	X	X	X	X	X	X		241	
7 Central Valley Limited	X	X	X	X	X		X	X				X	X	X		225	
9 San Fernando Valley Limited	X	X		X			X	X		X		X				198	
10 Central Valley Limited	X	X	X	X	X		X		X		X	X	X	X		228	
13 San Fernando Valley Limited	X		X	X					X	X	X	X	X	X		216	
14 SF-Merced	X	X	X	X	X	X										94	
15 LA-Merced						X	X	X	X	X	X	X	X	X		161	
16 Central Valley Limited	X	X	X	X	X		X	X				X				200	
17 San Fernando Valley Limited	X		X	X	X				X	X	X	X				196	
18 Central Valley Limited	X	X	X	X	X		X		X		X	X				203	
19 San Fernando Valley Limited	X		X	X	X				X	X		X				191	
20 Central Valley Limited	X	X	X	X			X	X		X		X				200	
21 San Fernando Valley Limited	X			X	X			X	X	X	X	X				199	

Northbound																End-to-End	
																Run Time	
Train Type/Pattern	ANA	NSF	LAU	BUR	SYL	PMD	BFD	FNO	MCD	GLY	SJC	RWC	SFO	SFT		(mins)	
1 Bay Area Limited	X	X	X							X	X	X		X		205	
2 Express	X	X	X								X			X		194	
4 All-Stop	X	X	X	X	X	X	X	X		X	X	X	X	X		240	
7 Central Valley Limited	X	X	X				X	X		X	X	X	X	X		223	
9 San Fernando Valley Limited			X		X		X	X			X		X	X		197	
10 Central Valley Limited	X	X	X	X		X		X		X	X		X	X		221	
13 San Fernando Valley Limited	X	X	X	X	X	X					X	X		X		216	
14 SF-Merced										X	X	X	X	X		94	
15 LA-Merced	X	X	X	X	X	X	X	X	X							163	
16 Central Valley Limited			X				X	X		X	X	X	X	X		197	
17 San Fernando Valley Limited			X	X	X	X				X	X	X		X		196	
18 Central Valley Limited			X	X		X		X		X	X	X	X	X		196	
19 San Fernando Valley Limited			X		X	X				X	X	X		X		191	
20 Central Valley Limited			X		X		X	X			X	X	X	X		198	
21 San Fernando Valley Limited			X	X	X	X	X			X	X	X		X		203	

In between these two service types are various categories of “Limited Stop” trains that make selected intermediate station stops but skip other stations. Several different limited stop patterns have been defined. They are grouped and named according to the part of the network within which they provide the greatest degree of service to individual intermediate stations. For instance, the “Bay Area Limiteds” make several stops within the Bay Area between San Francisco and Gilroy and then operate non-stop to Los Angeles. The “Central Valley Limiteds” stop at Fresno and/or Bakersfield but skip selected other intermediate stations, and the “San Fernando Valley Limiteds” make most or all of the stops between Los Angeles and Palmdale but skip many of the stations in the Bay Area and Central Valley. These “Limiteds” make up the majority of trains operating on the network and offer a compromise of a relatively fast run time along with connectivity among various groups of intermediate stations along the line.

The on-board travel time between stations varies, depending on the number of intermediate station stops (which is different for each train type) and the time of day (some trains have additional time built into their peak schedules to allow them to be “overtaken” by express or limited-stop trains while en route). The minimum or “fastest” trip times between selected city pair stations is presented in Table 4, based on the mix of train types and stopping patterns included in the Phase 1 service plan.

TABLE 4 – MINIMUM TRIP TIMES BETWEEN SELECTED STATIONS

(Based on Phase 1 Service Plan Train Stopping Patterns)

		Times in Hours:Minutes				
		SFT	SJC	FNO	LAU	ANA
SFT	San Francisco-Transbay	--	0:27	1:29	2:40	3:04
SJC	San Jose	0:27	--	0:50	2:11	2:35
FNO	Fresno	1:29	0:50	--	1:31	1:55
LAU	Los Angeles Union Station	2:40	2:11	1:31	--	0:22
ANA	Anaheim	3:04	2:35	1:55	0:22	--

		Times in Hours:Minutes				
		SFT	SJC	FNO	LAU	ANA
SFT	San Francisco-Transbay	--	0:28	1:31	2:44	3:08
SJC	San Jose	0:28	--	0:51	2:14	2:38
FNO	Fresno	1:31	0:51	--	1:33	1:57
LAU	Los Angeles Union Station	2:44	2:14	1:33	--	0:22
ANA	Anaheim	3:08	2:38	1:57	0:22	--

Note: The HST system is expected to operate at a high level of precision, with schedule pad allowances lower than for other intercity passenger rail corridors in the U.S. The development of system timetables will be based on tradeoffs that will need to be made among trip time, service reliability, alignment engineering, capital cost and operations and maintenance cost considerations.

**Explanation:* Table 4 (above) displays estimated timetable travel times between the city pairs presented in the matrix. For example, when reading the first row of the first table (with schedule pad allowance of 1%), the numbers shown represent the trip time between: San Francisco and San Jose (27 minutes minutes); San Francisco and Fresno (1 hour, 29 minutes); San Francisco and Los Angeles (2 hours, 40 minutes); and San Franciso and Anaheim (3 hours and 4 mintues).

Table 5 compares the service levels and stopping patterns originally assumed as the basis for high speed rail ridership and revenue estimates, and the proposed Phase 1 service plan. The original set of stopping patterns proved to be operationally infeasible, resulting in excessive numbers of overtakes and delays to trains being overtaken. Alternative patterns were examined that deliver

approximately the same level of service at each station, in terms of service frequency and the mix of express, limited stop and all-stop local service. Though the mix of stopping patterns has been modified, the number of trains per hour at each terminal and intermediate station is the same as or higher than what was assumed for the ridership demand forecasting purposes. The proposed mix of services offers regular clockface patterns, with each service type leaving at the same time each hour, with relatively limited exceptions. Slightly more service is assumed during the three hour peak periods in the morning and late afternoon.

TABLE 5 – PEAK AND OFF-PEAK SERVICE FREQUENCIES

ORIGINAL SERVICE PLAN ASSUMPTIONS FOR RIDERSHIP FORECASTING

PEAK HOUR STATION STOPS-SOUTHBOUND									
Pattern No. →	2	1	9	10	7	13	14	15	
	Super	Exp	Ltd A	Ltd B	NLAX	VX	SF-M	LA-M	
Trains per hour →	1	0.5	2	2	0.5	0.5	1.5	1.5	9.5
									TOTAL
SFT S.F.-Transbay	1	0.5	2	2	0.5	0.5	1.5		8
SFO Millbrae			2		0.5		1.5		4
RWC Redwood City		0.5		2	0.5	0.5	1.5		5
SJC San Jose	1	0.5	2	2	0.5	0.5	1.5		8
GLY Gilroy		0.5		2	0.5		1.5		4.5
MCD Merced							1.5	1.5	3
FNO Fresno			2		0.5			1.5	4
BFD Bakersfield			2		0.5			1.5	4
PMD Palmdale				2		0.5		1.5	4
SYL Sylmar			2			0.5		1.5	4
BUR Burbank				2		0.5		1.5	4
LAU L.A. Union Sta.	1	0.5	2	2	0.5	0.5		1.5	8
NSF Norwalk		0.5			0.5	0.5		1.5	3
ANA Anaheim		0.5			0.5	0.5		1.5	3

PEAK HOUR STATION STOPS-NORTHBOUND									
Pattern No. →	2	1	9	10	7	13	14	15	
	Super	Exp	Ltd A	Ltd B	NLAX	VX	SF-M	LA-M	
Trains per hour →	1	0.5	2	2	0.5	0.5	1.5	1.5	9.5
									TOTAL
ANA Anaheim		0.5			0.5	0.5		1.5	3
NSF Norwalk		0.5			0.5	0.5		1.5	3
LAU L.A. Union Sta.	1	0.5	2	2	0.5	0.5		1.5	8
BUR Burbank				2		0.5		1.5	4
SYL Sylmar			2			0.5		1.5	4
PMD Palmdale				2		0.5		1.5	4
BFD Bakersfield			2		0.5			1.5	4
FNO Fresno			2		0.5			1.5	4
MCD Merced							1.5	1.5	3
GLY Gilroy		0.5		2	0.5			1.5	4.5
SJC San Jose	1	0.5	2	2	0.5	0.5		1.5	8
RWC Redwood City		0.5		2	0.5	0.5		1.5	5
SFO Millbrae			2		0.5			1.5	4
SFT S.F.-Transbay	1	0.5	2	2	0.5	0.5		1.5	8

OFF-PEAK HOUR STATION STOPS									
Pattern No. →	2	1	9	10	7	13	14	15	4
	Super	Exp	Ltd A	Ltd B	NLAX	VX	SF-M	LA-M	Local
Trains per hour →	0	0.5	2	2	0.5	0	0.8	0.8	0.5
									TOTAL
SFT S.F.-Transbay	0	0.5	2	2	0.5	0	0.8		0.5
SFO Millbrae			2		0.5		0.8		0.5
RWC Redwood City		0.5		2	0.5	0	0.8		0.5
SJC San Jose	0	0.5	2	2	0.5	0	0.8		0.5
GLY Gilroy		0.5		2	0.5		0.8		0.5
MCD Merced							0.8	0.8	
FNO Fresno			2		0.5		0.8	0.5	3.8
BFD Bakersfield			2		0.5		0.8	0.5	3.8
PMD Palmdale				2		0	0.8	0.5	3.3
SYL Sylmar			2			0	0.8	0.5	3.3
BUR Burbank				2		0	0.8	0.5	3.3
LAU L.A. Union Sta.	0	0.5	2	2	0.5	0	0.8	0.5	6.3
NSF Norwalk		0.5			0.5	0	0.8	0.5	2.3
ANA Anaheim		0.5			0.5	0	0.8	0.5	2.3

PROPOSED PHASE 1 SERVICE PLAN Version 10

PEAK HOUR STATION STOPS-SOUTHBOUND												
Pattern No. →	2	1	14	15	18	19	20	21	4			
	Super	Exp	SF-M	LA-M	CV2	SFV2	CV3	SFV3	Local			
Trains per hour →	1	1	1	1	1	1	1	1	1	9		
										TOTAL		
SFT S.F.-Transbay	1	1	1		1	1	1	1	1	8		
SFO Millbrae			1		1		1		1	4		
RWC Redwood City		1	1		1	1	1		1	6		
SJC San Jose	1	1	1		1	1	1	1	1	8		
GLY Gilroy		1	1		1	1		1	1	6		
MCD Merced			1	1						2		
FNO Fresno			1	1			1		1	4		
BFD Bakersfield			1				1	1	1	4		
PMD Palmdale			1	1	1			1	1	5		
SYL Sylmar			1			1	1	1	1	5		
BUR Burbank				1	1				1	4		
LAU L.A. Union Sta.	1	1		1	1	1	1	1	1	8		
NSF Norwalk	1	1			1					4		
ANA Anaheim	1	1		1						4		

PEAK HOUR STATION STOPS-NORTHBOUND												
Pattern No. →	2	1	14	15	18	19	20	21	4			
	Super	Exp	SF-M	LA-M	CV2	SFV2	CV3	SFV3	Local			
Trains per hour →	1	1	1	1	1	1	1	1	1	9		
										TOTAL		
ANA Anaheim		1	1		1					4		
NSF Norwalk	1	1		1						4		
LAU L.A. Union Sta.	1	1		1	1	1	1	1	1	8		
BUR Burbank			1	1				1	1	4		
SYL Sylmar			1		1	1	1	1	1	5		
PMD Palmdale			1	1	1			1	1	5		
BFD Bakersfield			1				1	1	1	4		
FNO Fresno			1	1					1	4		
MCD Merced			1	1						2		
GLY Gilroy		1	1		1	1			1	6		
SJC San Jose	1	1	1		1	1	1	1	1	8		
RWC Redwood City		1	1			1	1	1	1	6		
SFO Millbrae			1		1		1		1	4		
SFT S.F.-Transbay	1	1	1		1	1	1	1	1	8		

OFF-PEAK HOUR STATION STOPS									
Pattern No. →	2	1	14	15	16	17			4
	Super	Exp	SF-M	LA-M	CV2	SFV2			Local
Trains per hour →	0	1.1	1	1	1.7	1.7			1.1
									TOTAL
SFT Anaheim		1.1		1					1.1
SFO Norwalk		1.1		1					1.1
RWC L.A. Union Sta.	0	1.1		1	1.7	1.7			1.1
SJC Burbank			1			1.7			1.1
GLY Sylmar			1			1.7			1.1
FNO Palmdale			1			1.7			1.1
BFD Bakersfield			1	1.7					1.1
PMD Fresno			1	1.7					1.1
MCD Merced			1	1					2
SYL Gilroy		1.1	1		1.7	2			1.1
BUR San Jose	0	1.1	1		1.7	1.7			1.1
LAU Redwood City		1.1	1		1.7	1.7			1.1
NSF Millbrae			1		1.7				1.1
ANA S.F.-Transbay	0	1.1	1		1.7	1.7			1.1

The Phase 1 service plan as outlined in this document and its attachments provides a level of service at each station that is generally equivalent to the level of service assumed in the development of the estimates of system ridership and revenue (for Phase 1). A similar methodology is being applied to the service and operations analysis of the HST project to include the extensions of the system to Sacramento and San Diego; the results of the analysis of the system extensions to Sacramento and San Diego will be reported in a separate Technical Memorandum at a later date.

Table 5 indicates a slight increase in the number of peak station stops at Redwood City, Gilroy, Palmdale and Sylmar on the San Fernando Valley and Central Valley Limited services (Patterns 18-21), with a slightly longer running time for these services than indicated in the original service plan for the limited stop services (Patterns 9 and 10). As the HST project studies continue to progress it would be prudent to consider a more detailed ridership estimation to assess the relative merits of these run time and service frequency tradeoffs.

TRAIN SCHEDULE DEVELOPMENT

The process of developing a feasible train schedule for the various combinations of stopping patterns, train origins and destinations and service frequencies entailed overlaying the various patterns in a graphical template known as a “stringline” – which is a diagram with clock time on the horizontal axis and location along the rail system on the vertical axis. Each train movement is represented by a line that traces its path along the network in both time and distance. The stringline for a non-stop train has a steeper slope than that of a multiple-stop train. Stringlines in the same direction of flow are not permitted to intersect one another except at locations where there are additional tracks (at passenger stations) available for faster trains to bypass slower or stopped trains. These locations are assumed to be limited to the areas surrounding the stations on the main portion of the HST line between Gilroy and Palmdale – where non-stop trains are permitted to bypass or “overtake” trains operating in the same direction and stopping at the station. It is also worthy to note that with these service levels and consistent stopping patterns, the conceptual analysis revealed that trains are able to run in sequence (without overtakes) north of Gilroy and south of Palmdale. This attribute is subject to further study and validation, and will be examined in detail when the full dispatch computer simulation is performed

Stringline diagrams were constructed in the spreadsheet model by starting with the highest priority trains (express trains running on clockface schedules), and then adding the other stopping patterns and frequencies in a priority order, adjusting the starting times of each subsequent group of trains to minimize the number of required overtakes and to make sure that all overtakes, when required, occur at the appropriate intermediate station locations. Additional station dwell time was added to the schedules of trains being overtaken, as necessary, to ensure that the minimum three minute separation between trains is maintained.

Hypothetical timetables are presented in the appendices. A timetable for the base service plan is presented in Appendix A1. This same schedule is represented in stringline format in Appendix A2, which shows the patterns of train movements during the morning peak, mid-day period, afternoon peak and late evening period. Appendix B presents the same information for the service plan variation based on three and one half percent and one percent recovery time allowances. A hypothetical timetable for this service plan variation is presented in Appendix B1, with this schedule represented in stringline format in Appendix B2.

Table 6 shows the number of scheduled trains, for each stopping pattern/service type, within the morning peak, mid-day, afternoon peak and late evening periods. The daily schedule provides a total of 260 revenue trains.

TABLE 6 – REVENUE TRAINS BY TIME PERIOD AND TRAIN TYPE

Pattern	Train Type	End Points	Daily Trains (both directions)				
			Morning Peak 3 Hrs	Mid-Day 7 Hrs	Afternoon Peak 3 Hrs	Late Evening 3+ Hrs	Total Daily
1	Bay Area Limited	SFT-ANA	6	14	6	8	34
2	Express	SFT-ANA	6	—	6	—	12
4	All-Stop Local	SFT-ANA	6	14	6	8	34
10	Central Valley Limited	SFT-ANA	2	—	2	—	4
14	San Francisco-Merced All-Stop	SFT-MCD	6	14*	6	6	32
15	Anaheim-Merced All-Stop	MCD-ANA	6	14*	6	6	32
16	Central Valley Limited	SFT-LAU	—	28	—	6	34
17	San Fernando Valley Limited	SFT-LAU	—	28	—	6	34
18	Central Valley Limited	SFT-LAU	4	—	4	—	8
19	San Fernando Valley Limited	SFT-LAU	6	—	6	—	12
20	Central Valley Limited	SFT-LAU	6	—	6	—	12
21	San Fernando Valley Limited	SFT-LAU	6	—	6	—	12
Total			54	112	54	40	260

*Assumes one mid-day interval of 2 hours instead of normal 1 hour headway, during period of lowest ridership demand.

Annual operating costs for HST service, in large measure, are estimated based on the number of train-miles of assumed service operated. Table 7 presents the annual train-miles associated with the Phase 1 service plan. This estimate is based on full daily service for 250 weekdays per year, plus 115 weekend days and holidays with a reduced level of service.

TABLE 7 – DAILY AND ANNUAL TRAIN-MILES

	Daily Train-Miles	Daily Train-Miles (200m equivalent)	Days/ Year	Annual Train-Miles (200m equivalent)
Weekday	106,211	140,405	250	35,101,000
Weekend & Holiday	83,760	83,760	115	9,632,000
Total	--	--	365	*44,734,000

* Average annual train miles per 200 meter trainset is estimated at approximately 426,000, assuming a Phase 1 fleet requirement of 105 trainsets including spares (assumed spare ratio of 10%).

ESTIMATED PASSENGER LOADS AND LOAD FACTORS

In order to estimate train consists and fleet requirements, and verify that the capacity of the Phase 1 service plan approximately matches demand, the estimated daily Phase 1 ridership in 2030 of 159,000 trips was factored to develop an approximation of demand by hour for the peak, peak shoulder and off-peak periods. Ridership projections for daily boardings at each station, and annual region-to-region trips factored down to average daily travel, were used to derive a station-to-station daily trip table, which is presented in Table 8 below. The assumed peaking factors are presented in Table 9.

TABLE 8 – ESTIMATED DAILY STATION-TO-STATION RIDERSHIP IN 2030 (PHASE 1)

Alighting Station...	Boarding Station...														Total
	San Francisco (Transbay)	Millbrae	Redwood City	San Jose	Gilroy	Merced	Fresno	Bakersfield	Palmdale	Sylmar	Burbank	Los Angeles Union Station	Norwalk	Anaheim	
SFT San Francisco (Transbay)	0	262	1,247	3,154	856	1,707	1,654	1,653	3,421	2,586	614	2,256	1,836	11,643	32,890
SFO Millbrae	262	0	352	891	242	68	66	66	137	104	25	91	74	467	2,845
RWC Redwood City	1,247	352	0	40	11	184	178	178	369	279	66	243	198	1,254	4,599
SJC San Jose	3,154	891	40	0	50	396	384	383	794	600	142	523	426	2,702	10,485
GLY Gilroy	856	242	11	50	0	306	297	296	615	465	110	405	330	2,092	6,074
MCD Merced	1,707	68	184	396	306	0	405	671	556	420	100	367	298	1,892	7,370
FNO Fresno	1,654	66	178	384	297	405	0	955	365	276	65	241	196	1,242	6,324
BFD Bakersfield	1,653	66	178	383	296	671	955	0	514	389	92	339	276	1,750	7,562
PMD Palmdale	3,421	137	369	794	615	556	365	514	0	135	360	6,473	826	2,499	17,063
SYL Sylmar	2,586	104	279	600	465	420	276	389	135	0	91	1,632	208	630	7,814
BUR Burbank	614	25	66	142	110	100	65	92	360	91	0	1,686	215	651	4,217
LAU Los Angeles Union Station	2,256	91	243	523	405	367	241	339	6,473	1,632	1,686	0	730	2,211	17,197
NSF Norwalk	1,836	74	198	426	330	298	196	276	826	208	215	730	0	0	5,613
ANA Anaheim	11,643	467	1,254	2,702	2,092	1,892	1,242	1,750	2,499	630	651	2,211	0	0	29,034
Total	32,890	2,845	4,599	10,485	6,074	7,370	6,324	7,562	17,063	7,814	4,217	17,197	5,613	29,034	159,087

TABLE 9 – RIDERSHIP PEAKING FACTORS

Origin-Destination Market	Peak Hour	Peak Shoulder Hour	6 peak hours	10 off-peak hours	Directional Peaking Factors	
					PM Peak South- bound	PM Peak North- bound
Inter-regional	12%	10%	54%	46%	1.0	1.0
Within MTC territory	17%	11%	67%	33%	1.2	0.8
Within SCAG territory	15%	10%	61%	39%	0.9	1.1

For the peak hour, average peak shoulder hour and average off-peak hour, station-to-station ridership was allocated among the available trains operating during those hours. Where choices among both express and local trains exist, a higher percentage of trips is allocated to the faster express services. Within each hour, overall demand is constrained by trainset seating capacity. Where the initial allocation of trips resulted in some trains being over capacity, a portion of the affected station-to-station loads were re-assigned to trains with available seating capacity operating within the same hour.

The graphs on the following pages show the estimated passenger loadings on the various train types for each station-to-station segment. In all cases, passenger loads can be kept within the 1,000 seat capacity of a 400 m trainset. The express services require 400 m trainsets all day long. The all-stop local trains, selected limited stop trains, and the Anaheim-Merced local trains all have passenger loads between 500 and 1,000 passengers, necessitating 400 m trainsets. All off-peak trains other than the hourly expresses have passenger loads under 500 and can be accommodated on 200 m trainsets.

FIGURE 1 – ESTIMATED PASSENGER LOADS IN 2030 – EVENING PEAK HOUR SOUTHBOUND

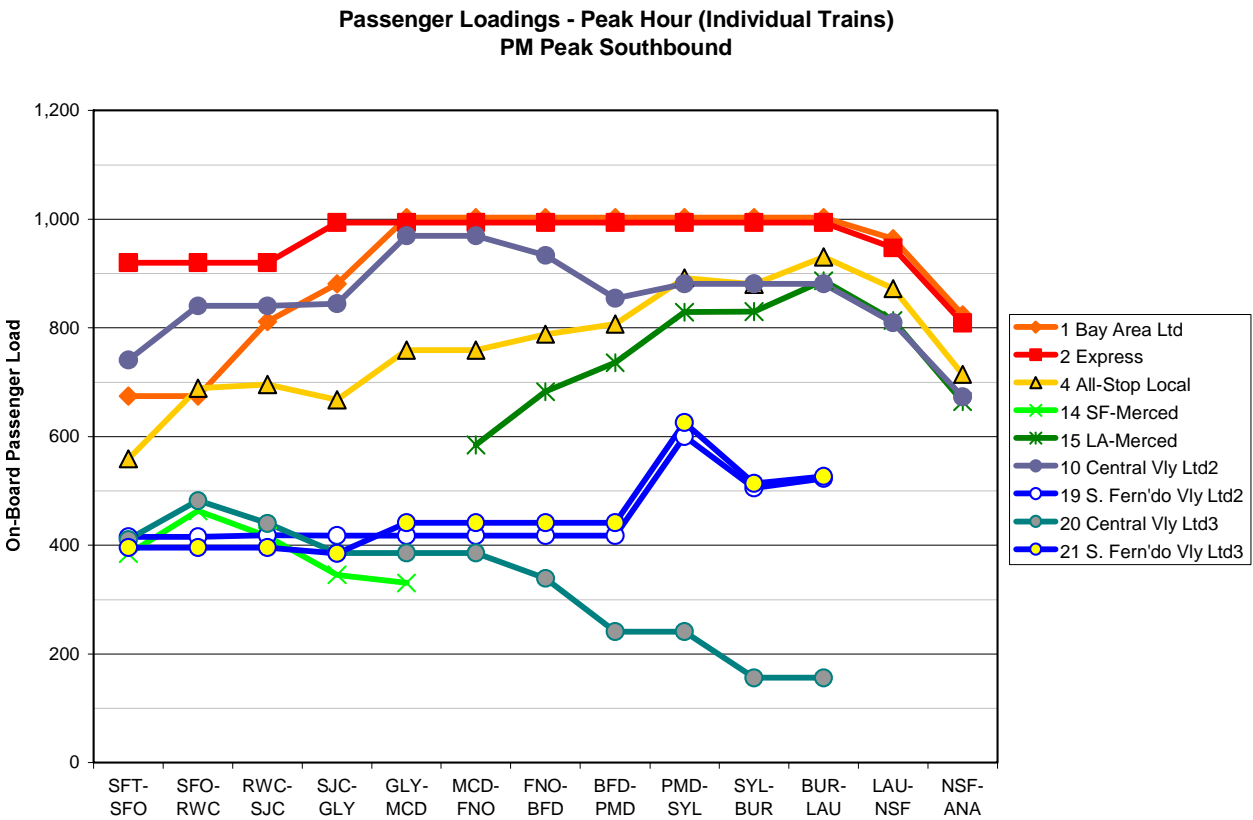


FIGURE 2 – ESTIMATED PASSENGER LOADS IN 2030 – EVENING PEAK SHOULDER HOUR SOUTHBOUND

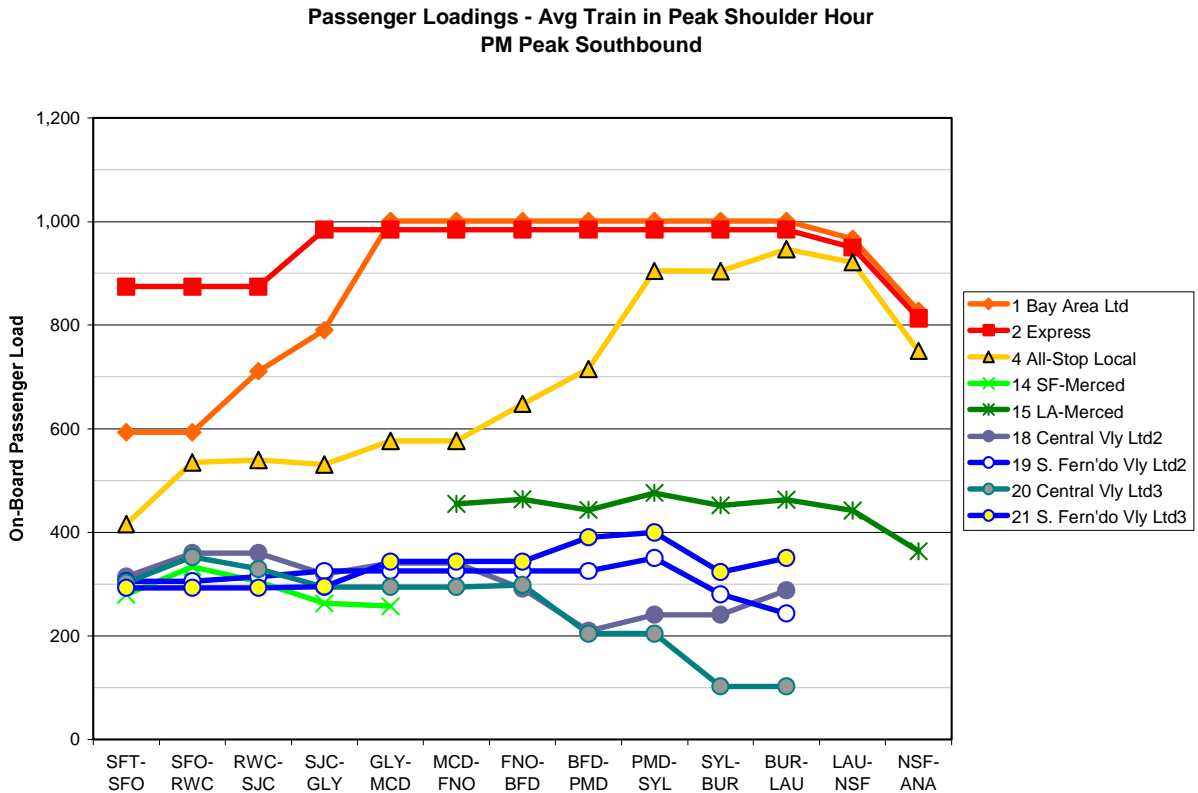


FIGURE 3 –
ESTIMATED PASSENGER LOADS IN 2030 – EVENING PEAK HOUR NORTHBOUND

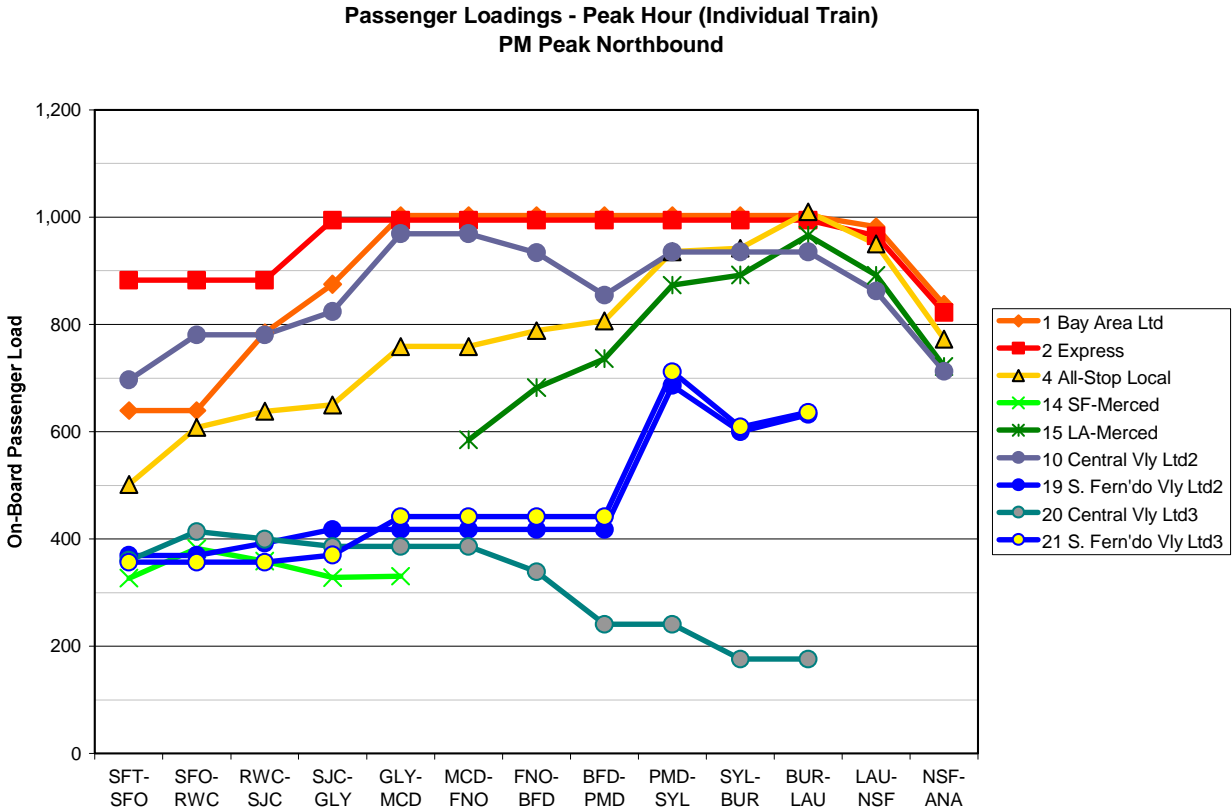


FIGURE 4 –
ESTIMATED PASSENGER LOADS IN 2030 – EVENING PEAK SHOULDER HOUR
NORTHBOUND

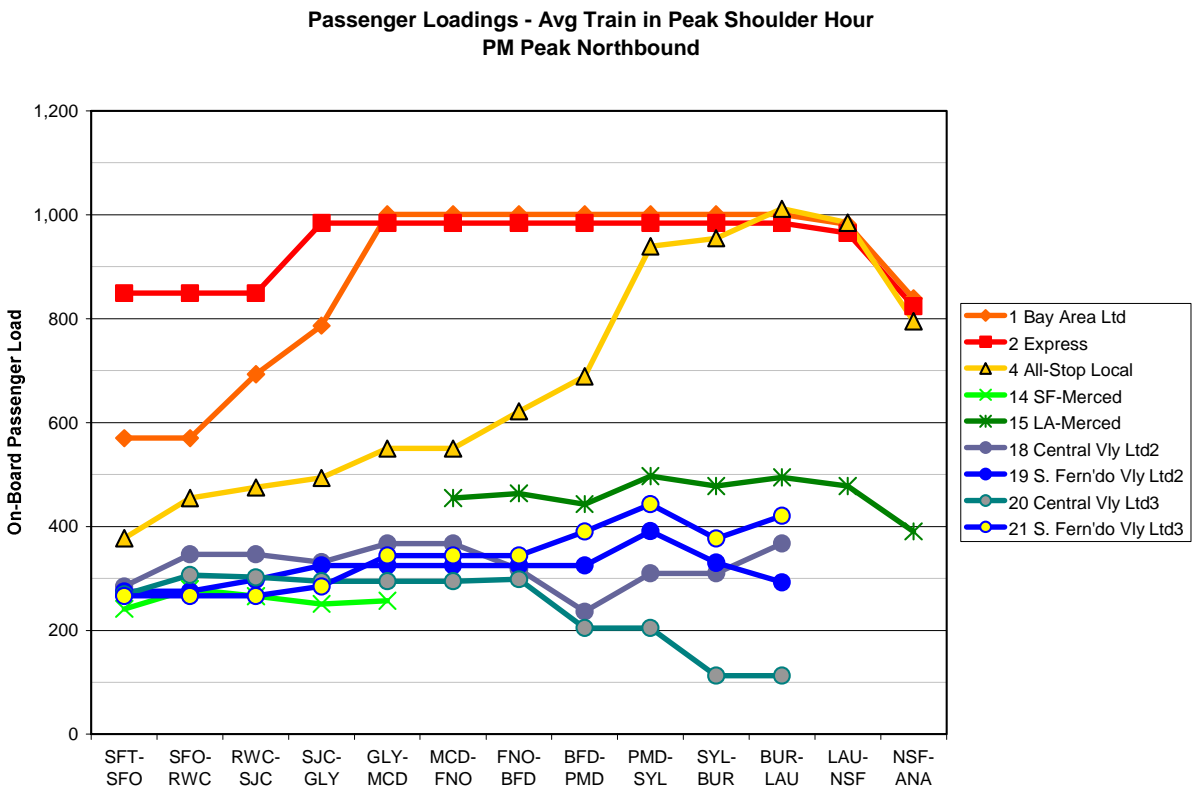
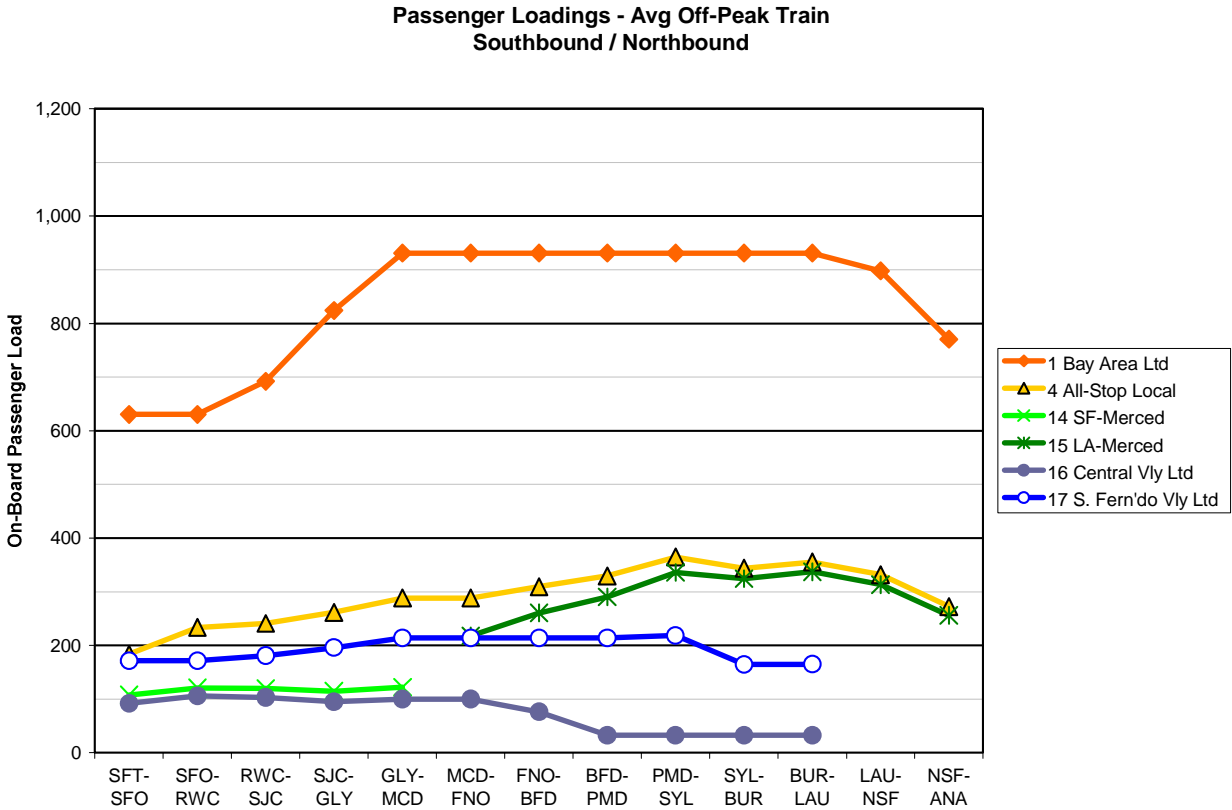


FIGURE 5 –
ESTIMATED PASSENGER LOADS IN 2030 – AVERAGE OFF-PEAK



5. FLEET REQUIREMENTS

EQUIPMENT CYCLES

The concept level train schedule presented in Appendix A, which shows 260 daily revenue trains, was analyzed to estimate the number of trainsets based upon the number of 200 m and 400 m trainsets required to meet forecasted 2030 demand. Trains arriving at a terminal station are assumed to lay over at the platform for a certain period of time, for passenger alighting train servicing/inspection and passenger boarding, then depart in the opposite direction as the next available departing revenue train. This analysis generally adhered to the minimum terminal layover times presented in Table 2. In certain cases, shorter layover times were assumed in order to keep the number of trainsets to a reasonable minimum and to avoid inordinately long layovers, which would occupy terminal station or yard tracks for extended periods of time. Except during the late evening time period, train sets are generally available at the SFT and ANA terminals to provide “protection” for short connections from potentially delayed trains. These additional equipment sets would be culled from the 400 m local and limited trains operating during the morning peak period that continue during the mid-day period as 200 m trains. The train turns at the endpoint terminals are balanced during the mid-day and late evening off-peak hours. During the peaks, additional directional service is offered, so a relatively small number of trains are designated for mid-day yard storage in lieu of making a revenue turn.

Most trainsets are able to make 3-4 trips between the Bay area and Los Angeles basin over the course of a service day. Selected trains (one per hour each way) operate to and from Merced. At Merced, these trains then turn for the next available train operating towards the alternate terminal (i.e., a San Francisco-Merced train will lay over at Merced and turn for a Merced-Anaheim train).

REVENUE TRAINSETS

A “baseline” total of sixty five (65), 200 m trainsets were estimated to operate the 260 daily train schedule in revenue service. An additional twenty-nine (29), 200m sets are required to “fill out” the 400m trainsets that serve the peak periods (and all-day express services), as shown in Table 10.

TABLE 10 – 200M TRAIN SECTIONS NEEDED TO “FILL OUT” 400M TRAINS

Bay Area Limited	9
Express	6
All-Stop Local	6
Anaheim-LA-Merced	2
Central Valley Limited	2
San Fernando Valley Limited	4
Total	29

6. TRAIN STORAGE REQUIREMENTS

The number of trainsets estimated to be stored at each terminal location during both the overnight period and the mid-day off-peak period was calculated for the Phase 1 service plan based on the Phase 1 equipment cycles. The sixty five (65) revenue trainset consists required for Phase 1, includes thirty-six (36) 200m trainsets and twenty-nine (29) 400m trainsets, were distributed among the four terminals for overnight storage as follows:

TABLE 11 – OVERNIGHT TRAIN STORAGE REQUIREMENTS

(Revenue Trainsets)

Location	200 m Sets	400 m Sets	Total Trainsets	200 m Equivalents	400 m Yard Tracks*
San Francisco	14	[13] 4 BayArea Ltd 3 Express 2 SF Vly Ltd 1 CenVly Ltd 3 All-Stop	27	40	20
Los Angeles	13	[2] 2 SF Vly Ltd	15	17	9
Anaheim	4	[13] 5 BayArea Ltd 3 Express 1 CenVly Ltd 3 All-Stop 1 LA-Merced	17	30	15
Merced	5	[1] 1 LA-Merced	6	7	4
Total	36	29	65	94	48

* Additional tracks will be required at most locations for train maneuvering and to support required maintenance functions. Allowances for extensions to Sacramento and San Diego to satisfy full system needs are not included and will be added later at the conclusion of the Sacramento and San Diego extensions Study which will follow this analysis and report.

The overnight train storage requirements influence the sizes of the required storage yards capacities significantly. Train storage yards can be configured in several different ways, depending upon the size and shape of the available property for yard storage. Yards could be configured as a series of double-ended 400m tracks capable of storing either one 400m train or two 200m trains. Or, yards could comprise a combination of 400m and 200m long tracks. The storage yards are assumed to be located in reasonable proximity to the terminal stations, to minimize the extent of non-revenue or “deadhead” train movements, although the yards do not need to be immediately adjacent to the stations. Detailed operations analysis of the terminal stations, storage yards and connecting trackage have not yet been performed but are planned to be undertaken at a future stage of project development. Utilization of tracks in terminal stations to supplement overnight storage capacity will be examined during this analysis.

All sixty five trainset consists are forecasted to be in active revenue during both the morning and afternoon peak periods. The mid-day off-peak train schedule (between approximately 11:00 AM and 3:00 PM) can be operated with fifty-eight revenue trainsets. The remaining seven trainsets (all 400m long) will be stored in the terminal and yards, along with an additional thirteen (13) 200m sets culled from trains that need to be 400m long to meet peak demand but which can be reduced to 200m long during the mid-day period to reduce the quantity of off-peak empty seat-mileage. The number of required mid-day storage tracks, by location, is presented in the following table.

TABLE 12 – MID-DAY TRAIN STORAGE REQUIREMENTS

(Revenue Trainsets)

Location	200 m Extra Sets	400 m Sets	Total Trainsets	200 m Equivalents	400 m Yard Tracks
San Francisco	[6] 2 SF Vly Ltd 1 CenVly Ltd 3 All-Stop	[3] 3 Express	9	12	6
Los Angeles	2 SF Vly Ltd		2	2	1
Anaheim	[4] 3 All-Stop 1 LA-Merced	[4] 3 Express 1 CenVly Ltd	8	12	6
Merced	1 LA-Merced	--	1	1	1
Total	13	7	20	27	14

APPENDICES – PHASE 1 SERVICE PLAN
CHARACTERISTICS

[A] BASE, WITH 7.0% RECOVERY TIME ALLOWANCE

To develop the base Phase 1 conceptual service plan and hypothetical train schedules, trains were applied to the schedule in the following sequence:

- San Francisco-Los Angeles-Anaheim Bay Area Limited service (Pattern #1) - (SFT-RWC-SJC-GLY-LAU-NSF-ANA)
 - Clockface departures on the hour southbound from SFT, with first departure at 5:00 AM and last departure at 9:00 PM
 - Clockface hourly departures northbound, from ANA at :35 and departing LAU at :00, with first departure at 4:35 AM and last departure at 8:35 PM
- San Francisco-Los Angeles Express service (Pattern #2) - (SFT-SJC-LAU)
 - Service provided only during the 3-hour morning and afternoon business travel peaks, one train per hour in each direction in each peak period
 - Clockface departures on the half hour southbound from SFT and northbound from LAU, with morning departures at approximately 5:30 AM, 6:30 AM and 7:30 AM and afternoon departures from Los Angeles at approximately 3:30 PM, 4:30 PM and 5:30 PM, and from Anaheim at :05 past the hour.
 - These trains are assumed to operate to Anaheim in Phase 1, in order to spread the peak period demand between the Bay Area and Anaheim among a greater number of trains.
- San Fernando Valley Ltd. (Patterns #19 and #21 peak, #17 off-peak) – Limited stop service between San Francisco and L.A., stopping at San Fernando Valley stations and generally bypassing Central Valley stops
 - 30-minute headways in both directions of travel all day long
 - Off-peak, southbound departures from SFT at :03 and :33; northbound departures from LAU at :10 and :40
 - Service operates without being overtaken
 - Service tapers after 7:00 pm
- Central Valley Ltd. (Patterns #18 and #20 peak, #16 off-peak) – Limited stop service between San Francisco and L.A. stopping at Fresno and Bakersfield and making limited stops within the San Fernando Valley
 - 30-minute headways in both directions of travel all day long
 - Off-peak, southbound departures from SFT at :08 and :38; northbound departures from LAU at :03 and :33
 - During off-peak hours, service operates without being overtaken
 - During peak hours, one of the two trains in each hour is overtaken in each direction (southbound at Fresno, northbound at Gilroy)
 - Peak train in each peak period operates to/from Anaheim (ANA) to provide additional required seating capacity at the height of the peak at Anaheim.

This page is intentionally kept blank to facilitate double-sided printing.

- Service tapers after 7:00 pm
5. All-stop service, to ensure direct train service connectivity among all possible station pairs (Pattern #4)
- Hourly service with clockface departure times, San Francisco to Anaheim all day long (Pattern #4, SFT-SFO-RWC-SJC-GLY-FNO-BFD-PMD-SYL-BUR-LAU-NSF-ANA)
 - Southbound trains depart SFT at :14
 - Northbound trains depart Anaheim (ANA) at :52, except during AM and PM business travel peaks, when these trains depart ANA at :46
 - During off-peak hours, the All-Stop trains are overtaken once per trip by limited stop trains, southbound at Bakersfield and northbound at Palmdale
 - During business travel peaks, southbound trains are overtaken twice, by the Super Express service, at Gilroy and by a limited stop train at Fresno; northbound All-Stop trains are overtaken once, at Bakersfield.
6. Anaheim-Los Angeles-Merced local service (Pattern #15)
- Hourly service with clockface departure times, San Francisco to Merced making all intermediate stops (MCD-FNO-BFD-PMD-SYL-BUR-LAU-NSF-ANA)
 - Off-peak trains depart Merced southbound at :02 and depart Anaheim northbound at :20.
 - Peak period trains have slightly different departure times on account of different overtake patterns: southbound from Merced at :19 and northbound from Anaheim at :19.
 - Provides for equipment rotations to/from storage and maintenance facility at Merced
 - These trains could be extended in the system expansions to Sacramento and San Diego
 - During off-peak times, these trains are overtaken by two closely-spaced express trains – northbound at Palmdale and southbound at Bakersfield (extra 6 minutes of dwell time)
 - During business travel peaks, southbound trains have the same double overtake at Bakersfield, and northbound trains are overtaken twice – at Palmdale and Fresno.
7. San Francisco-Merced local service (Pattern #14)
- Hourly service with clockface departure times, San Francisco to Merced making all intermediate stops (SFT-SFO-RWC-SJC-GLY-MCD)
 - Southbound trains depart SFT at :47; northbound trains depart Merced at :37
 - Provides for equipment rotations to/from storage and maintenance facility at Merced
 - These trains could be extended in the system expansions to Sacramento and San Diego
 - The relatively short distance of operation for this train on the San Francisco-Los Angeles network makes it easier to “slot in” around other trains without triggering an overtake – hence its position at the end of the priority sequence.

A hypothetical daily timetable for this service plan is presented in Appendix A1. This same schedule is presented in stringline (time-distance) diagram format in Appendix A2. Equipment cycles and the patterns of movement of each trainset throughout the day are documented in Appendix A3.

A1. Hypothetical Timetable

This page is intentionally kept blank to facilitate double-sided printing.

CALIFORNIA HIGH-SPEED RAIL

PHASE 1 TIMETABLE

BASE SERVICE PLAN

Turns from →

APPENDIX A1

Southbound

Mile Station

0.0 SFT	S.F.-Transbay	Dep		5:00	5:04		5:08	5:14	5:29	5:33	5:37	5:47	6:00	6:04		6:08	6:14	6:29	6:33	6:37	6:47	7:00	7:04		7:08	7:14	7:29	7:33	7:37	7:47		8:00	8:03	8:08		
14.7 SFO	Millbrae	Dep		--	--		5:24	5:30	--	--	5:53	6:03	--	--		6:24	6:30	--	--	6:53	7:03	--	--		7:24	7:30	--	--	7:53	8:03		--	--	8:24		
26.4 RWC	Redwood City	Dep		5:20	5:24		5:34	5:40	--	--	6:03	6:13	6:20	6:24		6:34	6:40	--	--	7:03	7:13	7:20	7:24		7:34	7:40	--	--	8:03	8:13		8:20	8:23	8:34		
48.0 SJC	San Jose	Dep		5:36	5:40		5:50	5:56	6:00	6:05	6:19	6:29	6:36	6:40		6:50	6:56	7:00	7:05	7:19	7:29	7:36	7:40		7:50	7:56	8:00	8:05	8:19	8:29		8:36	8:39	8:50		
77.7 GLY	Gilroy	Arr						6:11								7:11									8:11											
		Dep		5:53	5:57		6:07	6:16				6:46	6:53	6:57		7:07	7:16			7:21		7:46	7:53	7:57		8:07	8:16			8:21		8:46		8:53	8:56	9:07
187.5 MCD	Merced	Arr																																		
--		Dep	5:19			6:19	↓	↓				7:21			7:19	↓	↓							8:19	↓	↓				9:21		9:02			↓	
191.5 FNO	Fresno	Arr					6:48									7:48									8:48											
		Dep	5:42			6:42	6:52	7:03								7:52	8:03							8:42	8:52	9:03					9:25			9:50		
302.8 BFD	Bakersfield	Arr				7:21										8:21								9:21							10:04					
		Dep	6:22			7:29	--	--			7:38	7:54				8:29	--	--			8:38	8:54			9:29	--	--		9:38	9:54	10:10			10:30		
387.4 PMD	Palmdale	Arr																																		
		Dep	6:57		7:40	8:02	7:59	8:15			8:11	--			8:40	9:02	8:59	9:15			9:11	--			9:40	10:02	9:59	10:15		10:11	--	10:44		10:39		
425.7 SYL	Sylmar	Dep	7:19		8:02	8:24	--	8:36			8:33	8:44			9:02	9:24	--	9:36			9:33	9:44			10:02	10:24	--	10:36		10:33	10:44	11:06		11:01		
436.3 BUR	Burbank	Arr																																		
		Dep	7:28	↓	--	8:33	8:25	8:45	↓		8:42	--		--	9:33	9:25	9:45	↓		9:42	--		↓	--	10:33	10:25	10:45	↓		10:42	--		11:15	↓	11:10	↓
446.6 LAU	L.A. Union Sta.	Arr	7:36	8:00	8:15	8:42	8:34	8:54	8:18	8:51	8:57		9:00	9:15	9:42	9:34	9:54	9:18	9:51	9:57		10:00	10:15	10:42	10:34	10:54	10:18	10:51	10:57		11:23	11:00	11:19	11:27		
		Dep	7:38	8:02		8:44		8:56	8:20				9:02		9:44	9:36	9:56	9:20						10:02	10:44	10:56	10:20				11:25	11:02				
461.8 NSF	Norwalk	Arr	7:50	8:14		8:55		9:08	8:32				9:14		9:55	9:49	10:08	9:32					10:14		10:55		11:08	10:32			11:37	11:14				
476.9 ANA	Anaheim	Arr	8:01	8:25		9:07		9:19	8:43				9:25		10:07	9:59	10:19	9:43					10:25		11:07		11:19	10:43			11:48	11:25				

Available →	8:41	9:05	8:55	9:47	9:14	9:59	9:23	9:31	9:37	8:01	10:05	9:55	10:47	10:39	10:59	10:23	10:31	10:37	9:01	11:05	10:55	11:47	11:14	11:59	11:23	11:31	11:37	10:01	12:28	12:05	11:59	12:07
Turns for →																																

Turns from →

Northbound

Mile Station

0.0 ANA	Anaheim	Dep		4:35			4:46	5:05			5:19	5:35			5:46	6:05			6:19	6:35			6:42	6:46	7:05			7:20	7:35					
15.0 NSF	Norwalk	Dep		4:46			4:57	5:16			5:30	5:46			5:57	6:16			6:30	6:46			6:53	6:57	7:16			7:31	7:46					
30.3 LAU	L.A. Union Sta.	Arr		4:58			5:09	5:28			5:42	5:58			6:09	6:28			6:42	6:58			7:05	7:09	7:28			7:43	7:58					
		Dep		5:00		5:03	5:07	5:11	5:30	5:33	5:35	5:44	6:00		6:03	6:07	6:11	6:30	6:33	6:35	6:44	7:00		7:03	7:07	7:11	7:30	7:33	7:35	7:45	8:00		8:03	8:10
40.6 BUR	Burbank	Dep			--	5:17	--		--	5:45	5:54			--	6:17	--		--	6:45	6:54			--	7:17	--		--	7:45	7:55			8:27		
51.1 SYL	Sylmar	Dep			5:17	--	5:30		5:47	5:54	6:03			6:17	--	6:30		6:47	6:54	7:03			7:17	--	7:30		7:47	7:54	8:04			8:29		
89.4 PMD	Palmdale	Arr									6:23																							
		Dep			5:39	5:42	5:51		--	6:26	6:27			6:39	6:42	6:51		--	7:26	7:27			7:39	7:42	7:51		--	8:26	8:30			8:51		
174.1 BFD	Bakersfield	Arr					6:22								7:22																			
		Dep				--	6:27		6:37	6:49	7:02				7:27			7:37	7:49	8:02				--	8:27		8:37	8:49	9:05			9:00		
285.4 FNO	Fresno	Arr									7:41																							
		Dep				6:49	7:08		7:17		7:45			7:49	8:08			8:17		8:41	8:45			8:49	9:08		9:17		9:46			9:40		
354.4 MCD	Merced	Arr									8:07																							
--		Dep	5:37	↓	6:37	↓	↓					↓	7:37	↓	↓			↓	↓	9:07	↓		8:37	↓	↓	↓	↓		10:07	↓	9:37	↓	↓	
399.2 GLY	Gilroy	Arr																																
		Dep	6:13	7:09	7:13	7:23	7:36	7:51	↓	↓	8:06		8:09	8:13	8:23	8:36	8:51	↓	↓	9:06		9:09	9:13	9:23	9:36	9:51	↓	↓	10:06		10:09	10:13	10:24	10:34
428.8 SJC	San Jose	Dep	6:30	7:24	7:30	7:40	7:53	8:08	7:50	8:12	8:23		8:24	8:30	8:40	8:53	9:08	8:50	9:12	9:23		9:24	9:30	9:40	9:53	10:08	9:50	10:12	10:23		10:24	10:30	10:41	10:51
450.5 RWC	Redwood City	Arr	6:44	7:39	7:44	7:54	--	8:22	--	8:26	8:36		8:39	8:44	8:54	--	9:22	--	9:26	9:36		9:39	9:44	9:54	--	10:22	--	10:26	10:36		10:39	10:44	10:55	11:05
462.2 SFO	Millbrae	Arr	6:55	--	7:55	--	8:11	8:32	--	8:37	--		--	8:55	--	9:11	9:32	--	9:37	--		--	9:55	--	10:11	10:32	--	10:37	--		--	10:55	11:05	--
476.9 SFT	S.F.-Transbay	Arr	7:11	8:00	8:11	8:15	8:27	8:48	8:19	8:51	8:57		9:00	9:11	9:15	9:27	9:48	9:19	9:51	9:57		10:00	10:11	10:15	10:27	10:48	10:19	10:51	10:57		11:00	11:11	11:21	11:26

Available →	7:41	8:30	8:41	8:45	8:57	9:18	8:49	9:21	9:27	8:47	9:30	9:41	9:45	9:57	10:18	9:49	10:21	10:27	9:47	10:30	10:41	10:45	10:57	11:18	10:49	11:21	11:27	10:47	11:30	11:41	11:51	11:56
Turns for →																																

PHASE 1 TIMETABLE

Turns from \rightarrow

Southbound

Northbound

Mile Station

PHASE 1 TIMETABLE

Turns from \rightarrow

Pattern →

[illegible]

BASE SERVICE PLAN Turns from →

APPENDIX A1

Northbound

Turns from →

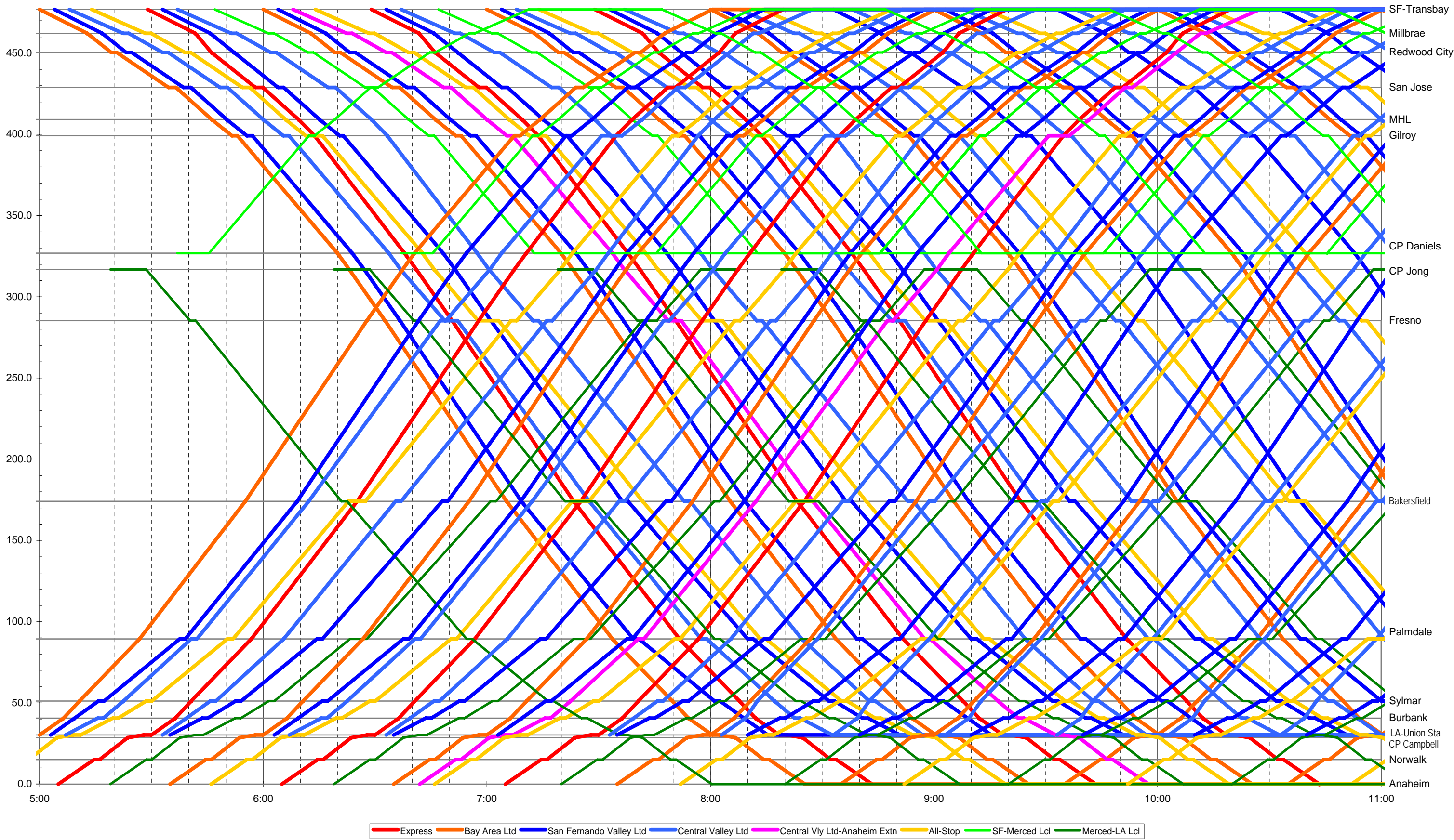
[illegible]

A2. Stringline Diagrams

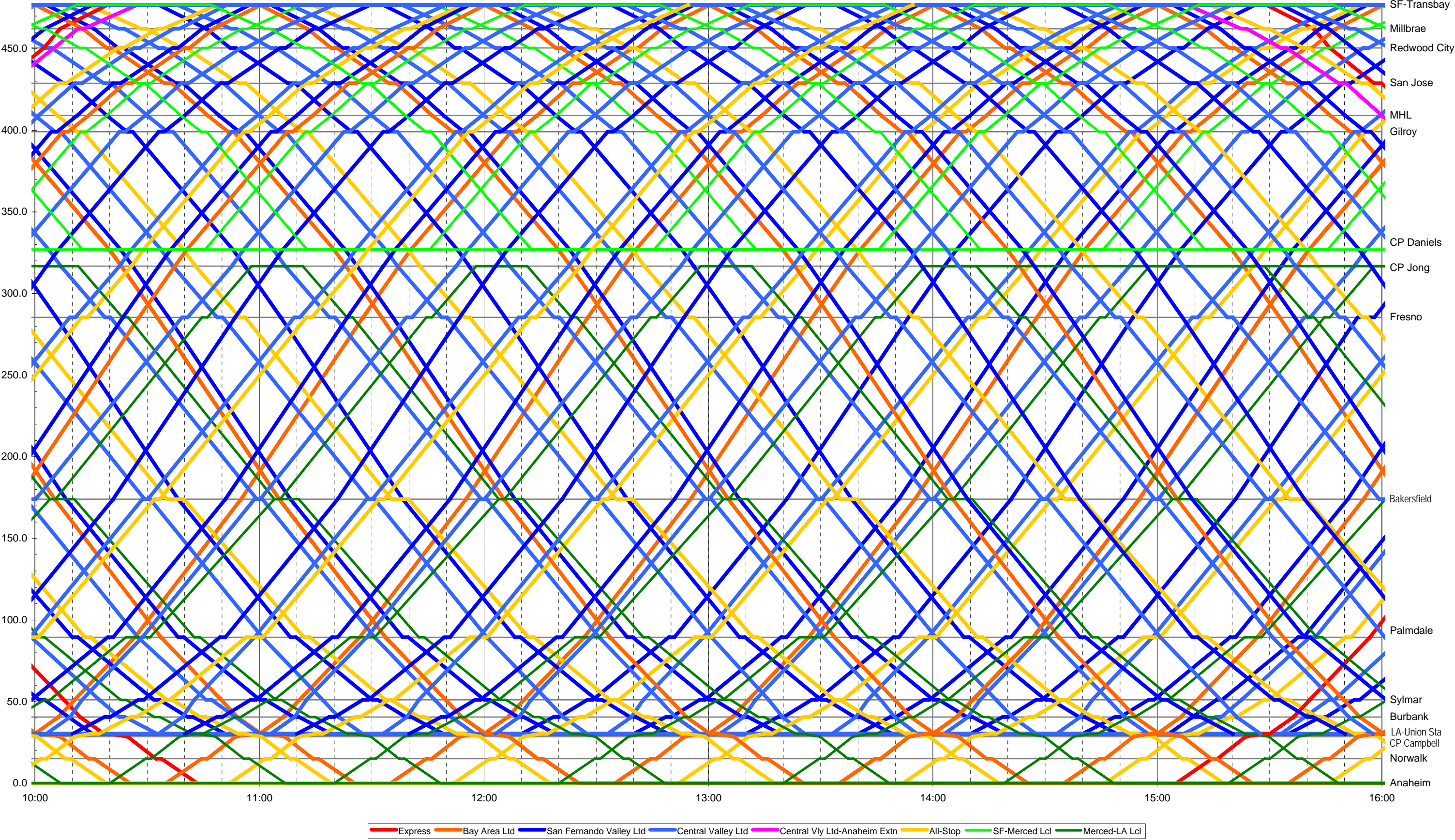
- Morning Peak Period
- Mid-Day Period
- Afternoon Peak Period
- Evening and Late Night Period

This page is intentionally kept blank to facilitate double-sided printing.

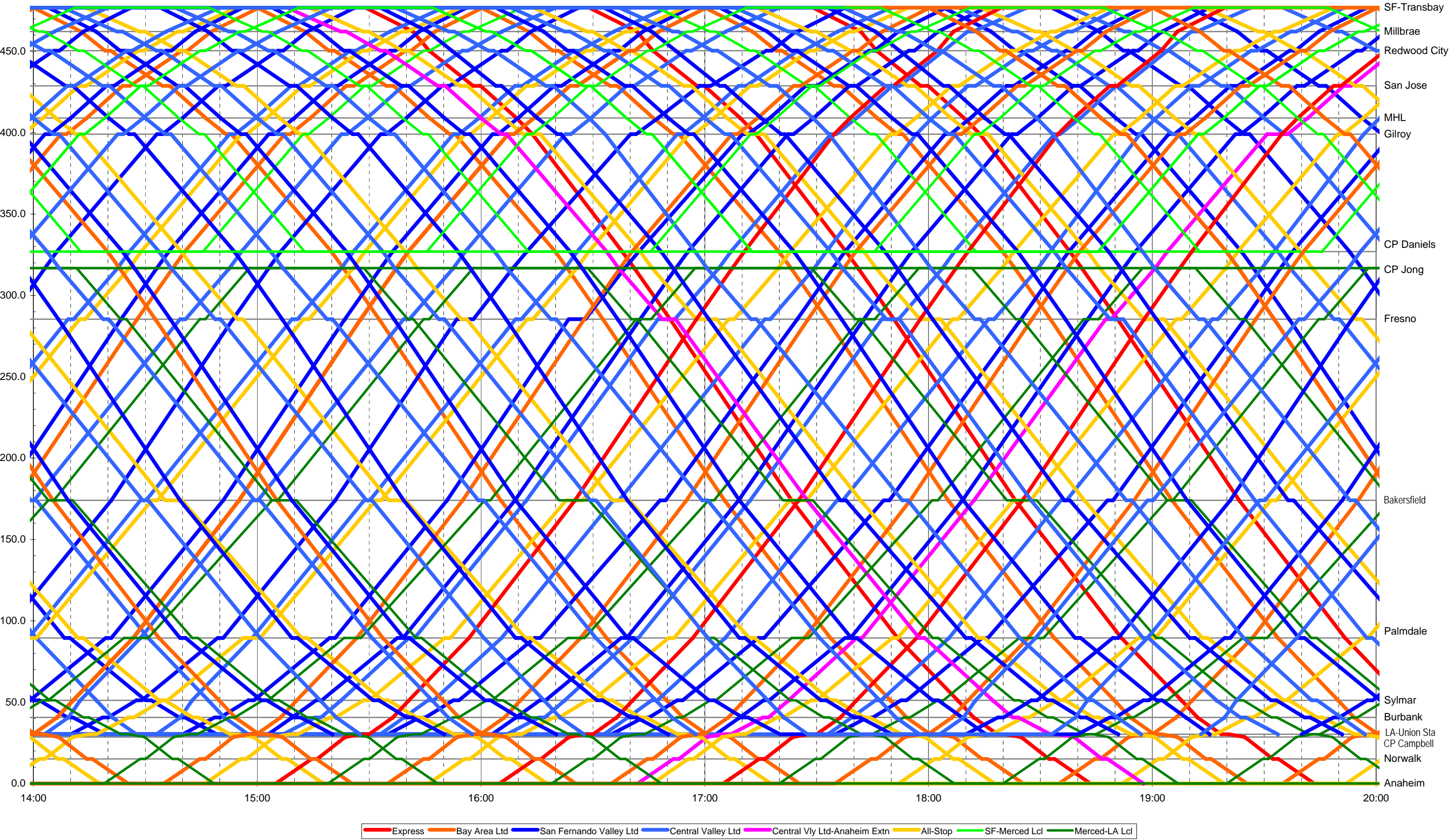
Appendix A2 - HST PHASE 1 SERVICE PLAN - BASE (Version 10) - MORNING PEAK



Appendix A2 - HST PHASE 1 SERVICE PLAN - BASE (Version 10) - MID-DAY



Appendix A2 - HST PHASE 1 SERVICE PLAN - BASE (Version 10) - AFTERNOON PEAK



Appendix A2 - HST PHASE 1 SERVICE PLAN - BASE (Version 10) - LATE EVENING



A3. Equipment Cycles

This page is intentionally kept blank to facilitate double-sided printing.

CALIFORNIA HIGH SPEED RAIL
APPENDIX A3 -- EQUIPMENT CYCLES -- PHASE 1 BASE SERVICE PLAN (Version 10)

ID	OvertkScheme	Dir	Set	Set2	Consist	Train No.	Pattern	Train Type	Orig	OrigTime	Dest	DestTime	RunTime	MinLay	Avail	Layover	Excess	DestArr	DestDep	T	TrnMi	200m SetMi	Wkend	Yd
2	Reg	SB	1	X11	400	S010500	1	Bay Area Ltd	SFT	5:00	ANA	8:25	3:25	40	9:05	0:55	15	8:25	9:20		476.9	953.8	476.9	
174	Peak O/T	NB	1			N140920	14	LA-Merced	ANA	9:20	MCD	12:08	2:48	30	12:38	0:29	(1)	12:08	12:37		354.3	354.3	354.3	
184	Reg	NB	1			N151237	15	SF-Merced	MCD	12:37	SFT	14:11	1:34	40	14:51	0:27	(13)	14:11	14:38	*	161.2	161.2	161.2	
83	Reg	SB	1			S161438	16	Central Vly. Ltd	SFT	14:38	LAU	17:57	3:19	40	18:37	0:43	3	17:57	18:40		446.6	446.6	0	
248	Reg	NB	1			N171840	17	S.Fernando Vly. Ltd	LAU	18:40	SFT	21:56	3:16	30	22:26	--	--	21:56	--		446.6	446.6	446.6	
3	Peak O/T	SB	2			S190504	19	S.Fernando Vly. Ltd	SFT	5:04	LAU	8:15	3:11	40	8:55	0:48	8	8:15	9:03		446.6	446.6	446.6	
169	Reg	NB	2			N160903	16	Central Vly. Ltd	LAU	9:03	SFT	12:21	3:18	30	12:51	0:39	9	12:21	13:00		446.6	446.6	0	
70	Reg	SB	2	X5	400	S011300	1	Bay Area Ltd	SFT	13:00	ANA	16:25	3:25	40	17:05	0:55	15	16:25	17:20		476.9	953.8	476.9	
241	Reg	NB	2		400	N141720	14	LA-Merced	ANA	17:20	MCD	20:07	2:47	30	20:37	0:30	0	20:07	20:37		354.3	708.6	354.3	
251	Reg	NB	2			N152037	15	SF-Merced	MCD	20:37	SFT	22:11	1:34	40	22:51	--	--	22:11	--		161.2	161.2	161.2	
5	Peak O/T	SB	3			S180508	18	Central Vly. Ltd	SFT	5:08	LAU	8:34	3:26	40	9:14	0:36	(4)	8:34	9:10		446.6	446.6	446.6	
170	Reg	NB	3			N170910	17	S.Fernando Vly. Ltd	LAU	9:10	SFT	12:26	3:16	30	12:56	0:37	7	12:26	13:03		446.6	446.6	446.6	
71	Peak O/T	SB	3			S171303	17	S.Fernando Vly. Ltd	SFT	13:03	LAU	16:19	3:16	40	16:59	0:44	4	16:19	17:03		446.6	446.6	446.6	
235	Peak O/T	NB	3		400	N191703	19	S.Fernando Vly. Ltd	LAU	17:03	SFT	20:15	3:12	30	20:45	0:32	2	20:15	20:47		446.6	893.2	446.6	
128	Reg	SB	3			S152047	15	SF-Merced	SFT	20:47	MCD	22:21	1:34	40	23:01	--	--	22:21	--		161.2	161.2	161.2	
6	Peak O/T	SB	4			S040514	4	All-Stop	SFT	5:14	ANA	9:19	4:05	40	9:59	0:51	11	9:19	10:10		476.9	476.9	476.9	
178	Reg	NB	4			N171010	17	S.Fernando Vly. Ltd	LAU	10:10	SFT	13:26	3:16	30	13:56	0:37	7	13:26	14:03		446.6	446.6	446.6	
78	Peak O/T	SB	4			S171403	17	S.Fernando Vly. Ltd	SFT	14:03	LAU	17:19	3:16	40	17:59	0:44	4	17:19	18:03		446.6	446.6	446.6	
244	Reg	NB	4			N161803	16	Central Vly. Ltd	LAU	18:03	SFT	21:21	3:18	30	21:51	--	--	21:21	--		446.6	446.6	0	
7	Reg	SB	5	SX1	400	S020529	2	Express	SFT	5:29	ANA	8:43	3:14	40	9:23	0:52	12	8:43	9:35		446.6	893.2	0	
175	Reg	NB	5	X11	400	N010935	1	Bay Area Ltd	ANA	9:35	SFT	13:00	3:25	30	13:30	0:47	17	13:00	13:47		476.9	953.8	476.9	
76	Reg	SB	5			S151347	15	SF-Merced	SFT	13:47	MCD	15:21	1:34	40	16:01	0:58	18	15:21	16:19		161.2	161.2	161.2	
87	Peak O/T	SB	5			S141619	14	LA-Merced	MCD	16:19	ANA	19:07	2:48	40	19:47	0:45	5	19:07	19:52		354.3	354.3	354.3	
257	Night	NB	5			N041952	4	All-Stop	ANA	19:52	SFT	23:51	3:59	30	0:21	--	--	23:51	--		476.9	476.9	476.9	
8	Peak O/T	SB	6			S210533	21	S.Fernando Vly. Ltd	SFT	5:33	LAU	8:51	3:18	40	9:31	0:42	2	8:51	9:33		446.6	446.6	446.6	
172	Reg	NB	6			N160933	16	Central Vly. Ltd	LAU	9:33	SFT	12:51	3:18	30	13:21	0:17	(13)	12:51	13:08	*	446.6	446.6	0	
72	Reg	SB	6			S161308	16	Central Vly. Ltd	SFT	13:08	LAU	16:27	3:19	40	17:07	0:38	(2)	16:27	17:05		446.6	446.6	0	
238	Reg	NB	6	SX6	400	N021705	2	Express	ANA	17:05	SFT	20:19	3:14	30	20:49	--	--	20:19	--		446.6	893.2	0	
9	Peak O/T	SB	7			S200537	20	Central Vly. Ltd	SFT	5:37	LAU	8:57	3:20	40	9:37	0:43	3	8:57	9:40		446.6	446.6	446.6	
173	Reg	NB	7			N170940	17	S.Fernando Vly. Ltd	LAU	9:40	SFT	12:56	3:16	30	13:26	0:37	7	12:56	13:33		446.6	446.6	446.6	
74	Reg	SB	7			S171333	17	S.Fernando Vly. Ltd	SFT	13:33	LAU	16:49	3:16	40	17:29	0:44	4	16:49	17:33		446.6	446.6	446.6	
239	Peak O/T	NB	7			N201733	20	Central Vly. Ltd	LAU	17:33	SFT	20:51	3:18	30	21:21	--	--	20:51	--		446.6	446.6	446.6	
10	Reg	SB	8			S150547	15	SF-Merced	SFT	5:47	MCD	7:21	1:34	40	8:01	0:58	18	7:21	8:19		161.2	161.2	161.2	
22	Peak O/T	SB	8			S140819	14	LA-Merced	MCD	8:19	ANA	11:07	2:48	40	11:47	0:45	5	11:07	11:52		354.3	354.3	354.3	
195	Reg	NB	8			N041152	4	All-Stop	ANA	11:52	SFT	15:54	4:02	30	16:24	0:20	(10)	15:54	16:14	*	476.9	476.9	476.9	
98	Peak O/T	SB	8		400	S041614	4	All-Stop	SFT	16:14	ANA	20:19	4:05	40	20:59	--	--	20:19	--		476.9	953.8	476.9	
11	Reg	SB	9	X12	400	S010600	1	Bay Area Ltd	SFT	6:00	ANA	9:25	3:25	40	10:05	0:55	15	9:25	10:20		476.9	953.8	476.9	
182	Reg	NB	9			N141020	14	LA-Merced	ANA	10:20	MCD	13:07	2:47	30	13:37	0:30	0	13:07	13:37		354.3	354.3	354.3	
192	Reg	NB	9			N151337	15	SF-Merced	MCD	13:37	SFT	15:11	1:34	40	15:51	0:26	(14)	15:11	15:37	*	161.2	161.2	161.2	
92	Peak O/T	SB	9			S201537	20	Central Vly. Ltd	SFT	15:37	LAU	18:57	3:20	40	19:37	--	--	18:57	--		446.6	446.6	446.6	
12	Peak O/T	SB	10			S190604	19	S.Fernando Vly. Ltd	SFT	6:04	LAU	9:15	3:11	40	9:55	0:48	8	9:15	10:03		446.6	446.6	446.6	
177	Reg	NB	10			N161003	16	Central Vly. Ltd	LAU	10:03	SFT	13:21	3:18	30	13:51	0:39	9	13:21	14:00		446.6	446.6	0	
77	Reg	SB	10	X11	400	S011400	1	Bay Area Ltd	SFT	14:00	ANA	17:25	3:25	40	18:05	0:55	15	17:25	18:20		476.9	953.8	476.9	
249	Reg	NB	10			N141820	14	LA-Merced	ANA	18:20	MCD	21:07	2:47	30	21:37	--	--	21:07	--		354.3	354.3	354.3	
14	Peak O/T	SB	11		400	S100608	10	Central Vly. Ltd Ext.	SFT	6:08	ANA	9:59	3:51	40	10:39	5:06	266	9:59	15:05		476.9	953.8	0	YAN
220	Reg	NB	11	SX4	400	N021505	2	Express	ANA	15:05	SFT	18:19	3:14	30	18:49	0:41	11	18:19	19:00		446.6	893.2	0	
121	Reg	SB	11	X2	400	S011900	1	Bay Area Ltd	SFT	19:00	ANA	22:25	3:25	40	23:05	--	--	22:25	--		476.9	953.8	476.9	
15	Peak O/T	SB	12		400	S040614	4	All-Stop	SFT	6:14	ANA	10:19	4:05	40	10:59	5:46	306	10:19	16:05		476.9	953.8	476.9	YAN
229	Reg	NB	12	SX5	400	N021605	2	Express	ANA	16:05	SFT	19:19	3:14	30	19:49	--	--	19:19	--		446.6	893.2	0	
16	Reg	SB	13	SX2	400	S020629	2	Express	SFT	6:29	ANA	9:43	3:14	40	10:23	0:52	12	9:43	10:35		446.6	893.2	0	
183	Reg	NB	13	X12	400	N011035	1	Bay Area Ltd	ANA	10:35	SFT	14:00	3:25	30	14:30	0:47	17	14:00	14:47		476.9	953.8	476.9	

CALIFORNIA HIGH SPEED RAIL
APPENDIX A3 -- EQUIPMENT CYCLES -- PHASE 1 BASE SERVICE PLAN (Version 10)

ID	OvertkScheme	Dir	Set	Set2	Consist	Train No.	Pattern	Train Type	Orig	OrigTime	Dest	DestTime	RunTime	MinLay	Avail	Layover	Excess	DestArr	DestDep	T	TrnMi	200m SetMi	Wkend	Yd
84	Reg	SB	13			S151447	15	SF-Merced	SFT	14:47	MCD	16:21	1:34	40	17:01	0:58	18	16:21	17:19		161.2	161.2	161.2	
96	Peak O/T	SB	13		400	S141719	14	LA-Merced	MCD	17:19	ANA	20:07	2:48	40	20:47	0:45	5	20:07	20:52		354.3	708.6	354.3	
260	Night	NB	13			N042052	4	All-Stop	ANA	20:52	SFT	0:51	3:59	30	1:21	--	--	0:51	--		476.9	476.9	476.9	
17	Peak O/T	SB	14		400	S210633	21	S.Fernando Vly. Ltd	SFT	6:33	LAU	9:51	3:18	40	10:31	0:42	2	9:51	10:33		446.6	893.2	446.6	
180	Reg	NB	14			N161033	16	Central Vly. Ltd	LAU	10:33	SFT	13:51	3:18	30	14:21	0:17	(13)	13:51	14:08	*	446.6	446.6	0	
80	Reg	SB	14			S161408	16	Central Vly. Ltd	SFT	14:08	LAU	17:27	3:19	40	18:07	0:43	3	17:27	18:10		446.6	446.6	0	
245	Reg	NB	14			N171810	17	S.Fernando Vly. Ltd	LAU	18:10	SFT	21:26	3:16	30	21:56	--	--	21:26	--		446.6	446.6	446.6	
18	Peak O/T	SB	15			S200637	20	Central Vly. Ltd	SFT	6:37	LAU	9:57	3:20	40	10:37	0:43	3	9:57	10:40		446.6	446.6	446.6	
181	Reg	NB	15			N171040	17	S.Fernando Vly. Ltd	LAU	10:40	SFT	13:56	3:16	30	14:26	0:37	7	13:56	14:33		446.6	446.6	446.6	
82	Reg	SB	15			S171433	17	S.Fernando Vly. Ltd	SFT	14:33	LAU	17:49	3:16	40	18:29	0:44	4	17:49	18:33		446.6	446.6	446.6	
247	Reg	NB	15			N161833	16	Central Vly. Ltd	LAU	18:33	SFT	21:51	3:18	30	22:21	--	--	21:51	--		446.6	446.6	0	
19	Reg	SB	16			S150647	15	SF-Merced	SFT	6:47	MCD	8:21	1:34	40	9:01	0:41	1	8:21	9:02		161.2	161.2	161.2	
29	Reg	SB	16			S140902	14	LA-Merced	MCD	9:02	ANA	11:48	2:46	40	12:28	0:47	7	11:48	12:35		354.3	354.3	354.3	
199	Reg	NB	16	X14	400	N011235	1	Bay Area Ltd	ANA	12:35	SFT	16:00	3:25	30	16:30	0:47	17	16:00	16:47		476.9	953.8	476.9	
102	Reg	SB	16			S151647	15	SF-Merced	SFT	16:47	MCD	18:21	1:34	40	19:01	0:41	1	18:21	19:02		161.2	161.2	161.2	
112	Reg	SB	16			S141902	14	LA-Merced	MCD	19:02	ANA	21:48	2:46	40	22:28	--	--	21:48	--		354.3	354.3	354.3	
20	Reg	SB	17	X13	400	S010700	1	Bay Area Ltd	SFT	7:00	ANA	10:25	3:25	40	11:05	0:55	15	10:25	11:20		476.9	953.8	476.9	
190	Reg	NB	17			N141120	14	LA-Merced	ANA	11:20	MCD	14:07	2:47	30	14:37	0:30	0	14:07	14:37		354.3	354.3	354.3	
200	Reg	NB	17			N151437	15	SF-Merced	MCD	14:37	SFT	16:11	1:34	40	16:51	0:26	(14)	16:11	16:37	*	161.2	161.2	161.2	
101	Peak O/T	SB	17			S201637	20	Central Vly. Ltd	SFT	16:37	LAU	19:57	3:20	40	20:37	--	--	19:57	--		446.6	446.6	446.6	
21	Peak O/T	SB	18		400	S190704	19	S.Fernando Vly. Ltd	SFT	7:04	LAU	10:15	3:11	40	10:55	0:48	8	10:15	11:03		446.6	893.2	446.6	
185	Reg	NB	18			N161103	16	Central Vly. Ltd	LAU	11:03	SFT	14:21	3:18	30	14:51	0:39	9	14:21	15:00		446.6	446.6	0	
85	Reg	SB	18	X12	400	S011500	1	Bay Area Ltd	SFT	15:00	ANA	18:25	3:25	40	19:05	0:55	15	18:25	19:20		476.9	953.8	476.9	
255	Reg	NB	18			N141920	14	LA-Merced	ANA	19:20	MCD	22:07	2:47	30	22:37	--	--	22:07	--		354.3	354.3	354.3	
23	Peak O/T	SB	19			S180708	18	Central Vly. Ltd	SFT	7:08	LAU	10:34	3:26	40	11:14	0:36	(4)	10:34	11:10		446.6	446.6	446.6	
186	Reg	NB	19			N171110	17	S.Fernando Vly. Ltd	LAU	11:10	SFT	14:26	3:16	30	14:56	0:38	8	14:26	15:04		446.6	446.6	446.6	
86	Peak O/T	SB	19			S191504	19	S.Fernando Vly. Ltd	SFT	15:04	LAU	18:15	3:11	40	18:55	0:58	18	18:15	19:13		446.6	446.6	446.6	
252	Reg	NB	19			N161913	16	Central Vly. Ltd	LAU	19:13	SFT	22:31	3:18	30	23:01	--	--	22:31	--		446.6	446.6	0	
24	Peak O/T	SB	20		400	S040714	4	All-Stop	SFT	7:14	ANA	11:19	4:05	40	11:59	5:23	283	11:19	16:42		476.9	953.8	476.9	YAN
236	Peak O/T	NB	20		400	N101642	10	Central Vly. Ltd Ext.	ANA	16:42	SFT	20:27	3:45	30	20:57	0:33	3	20:27	21:00		476.9	953.8	0	
129	Reg	SB	20	X4	400	S012100	1	Bay Area Ltd	SFT	21:00	ANA	0:25	3:25	40	1:05	--	--	0:25	--		476.9	953.8	476.9	
25	Reg	SB	21	SX3	400	S020729	2	Express	SFT	7:29	ANA	10:43	3:14	40	11:23	0:52	12	10:43	11:35		446.6	893.2	0	
191	Reg	NB	21	X13	400	N011135	1	Bay Area Ltd	ANA	11:35	SFT	15:00	3:25	30	15:30	0:47	17	15:00	15:47		476.9	953.8	476.9	
93	Reg	SB	21			S151547	15	SF-Merced	SFT	15:47	MCD	17:21	1:34	40	18:01	0:41	1	17:21	18:02		161.2	161.2	161.2	
103	Reg	SB	21			S141802	14	LA-Merced	MCD	18:02	ANA	20:48	2:46	40	21:28	--	--	20:48	--		354.3	354.3	354.3	
26	Peak O/T	SB	22			S210733	21	S.Fernando Vly. Ltd	SFT	7:33	LAU	10:51	3:18	40	11:31	0:42	2	10:51	11:33		446.6	446.6	446.6	
188	Reg	NB	22			N161133	16	Central Vly. Ltd	LAU	11:33	SFT	14:51	3:18	30	15:21	0:17	(13)	14:51	15:08	*	446.6	446.6	0	
88	Peak O/T	SB	22		400	S101508	10	Central Vly. Ltd Ext.	SFT	15:08	ANA	18:59	3:51	40	19:39	--	--	18:59	--		476.9	953.8	0	
27	Peak O/T	SB	23			S200737	20	Central Vly. Ltd	SFT	7:37	LAU	10:57	3:20	40	11:37	0:43	3	10:57	11:40		446.6	446.6	446.6	
189	Reg	NB	23			N171140	17	S.Fernando Vly. Ltd	LAU	11:40	SFT	14:56	3:16	30	15:26	0:37	7	14:56	15:33		446.6	446.6	446.6	
91	Peak O/T	SB	23			S211533	21	S.Fernando Vly. Ltd	SFT	15:33	LAU	18:51	3:18	40	19:31	0:49	9	18:51	19:40		446.6	446.6	446.6	
254	Reg	NB	23			N171940	17	S.Fernando Vly. Ltd	LAU	19:40	SFT	22:56	3:16	30	23:26	--	--	22:56	--		446.6	446.6	446.6	
28	Reg	SB	24			S150747	15	SF-Merced	SFT	7:47	MCD	9:21	1:34	40	10:01	0:41	1	9:21	10:02		161.2	161.2	161.2	
37	Reg	SB	24			S141002	14	LA-Merced	MCD	10:02	ANA	12:48	2:46	40	13:28	0:47	7	12:48	13:35		354.3	354.3	354.3	
207	Reg	NB	24	X1	400	N011335	1	Bay Area Ltd	ANA	13:35	SFT	17:00	3:25	30	17:30	0:29	(1)	17:00	17:29		476.9	953.8	476.9	
108	Reg	SB	24	SX6	400	S021729	2	Express	SFT	17:29	ANA	20:43	3:14	40	21:23	--	--	20:43	--		446.6	893.2	0	
30	Reg	SB	25	X14	400	S010800	1	Bay Area Ltd	SFT	8:00	ANA	11:25	3:25	40	12:05	0:55	15	11:25	12:20		476.9	953.8	476.9	
198	Reg	NB	25			N141220	14	LA-Merced	ANA	12:20	MCD	15:07	2:47	30	15:37	0:30	0	15:07	15:37		354.3	354.3	354.3	
208	Reg	NB	25			N151537	15	SF-Merced	MCD	15:37	SFT	17:11	1:34	40	17:51	0:26	(14)	17:11	17:37	*	161.2	161.2	161.2	
110	Peak O/T	SB	25			S201737	20	Central Vly. Ltd	SFT	17:37	LAU	20:57	3:20	40	21:37	--	--	20:57	--		446.6	446.6	446.6	
32	Reg	SB	26			S160808	16	Central Vly. Ltd	SFT	8:08	LAU	11:27	3:19	40	12:07	0:43	3	11:27	12:10		446.6	446.6	0	

CALIFORNIA HIGH SPEED RAIL
APPENDIX A3 -- EQUIPMENT CYCLES -- PHASE 1 BASE SERVICE PLAN (Version 10)

ID	OvertrScheme	Dir	Set	Set2	Consist	Train No.	Pattern	Train Type	Orig	OrigTime	Dest	DestTime	RunTime	MinLay	Avail	Layover	Excess	DestArr	DestDep	T	TrnMi	200m SetMi	Wkend	Yd
194	Reg	NB	26			N171210	17	S.Fernando Vly. Ltd	LAU	12:10	SFT	15:26	3:16	30	15:56	0:38	8	15:26	16:04		446.6	446.6	446.6	
95	Peak O/T	SB	26			S191604	19	S.Fernando Vly. Ltd	SFT	16:04	LAU	19:15	3:11	40	19:55	--	--	19:15	--		446.6	446.6	446.6	
33	Reg	SB	27		400	S040814	4	All-Stop	SFT	8:14	ANA	12:17	4:03	40	12:57	0:35	(5)	12:17	12:52		476.9	953.8	476.9	
203	Reg	NB	27			N041252	4	All-Stop	ANA	12:52	SFT	16:54	4:02	30	17:24	0:20	(10)	16:54	17:14	*	476.9	476.9	476.9	
107	Peak O/T	SB	27		400	S041714	4	All-Stop	SFT	17:14	ANA	21:19	4:05	40	21:59	--	--	21:19	--		476.9	953.8	476.9	
132	Reg	NB	41	X1	400	N010435	1	Bay Area Ltd	ANA	4:35	SFT	8:00	3:25	30	8:30	0:33	3	8:00	8:33		476.9	953.8	476.9	
34	Reg	SB	41			S170833	17	S.Fernando Vly. Ltd	SFT	8:33	LAU	11:49	3:16	40	12:29	0:44	4	11:49	12:33		446.6	446.6	446.6	
196	Reg	NB	41			N161233	16	Central Vly. Ltd	LAU	12:33	SFT	15:51	3:18	30	16:21	0:17	(13)	15:51	16:08	*	446.6	446.6	0	
97	Peak O/T	SB	41			S181608	18	Central Vly. Ltd	SFT	16:08	LAU	19:34	3:26	40	20:14	--	--	19:34	--		446.6	446.6	446.6	
136	Peak O/T	NB	42			N040446	4	All-Stop	ANA	4:46	SFT	8:48	4:02	30	9:18	0:26	(4)	8:48	9:14		476.9	476.9	476.9	
41	Reg	SB	42			S040914	4	All-Stop	SFT	9:14	ANA	13:17	4:03	40	13:57	0:35	(5)	13:17	13:52		476.9	476.9	476.9	
211	Reg	NB	42			N041352	4	All-Stop	ANA	13:52	SFT	17:54	4:02	30	18:24	0:09	(21)	17:54	18:03	*	476.9	476.9	476.9	
114	Reg	SB	42			S171803	17	S.Fernando Vly. Ltd	SFT	18:03	LAU	21:19	3:16	40	21:59	--	--	21:19	--		446.6	446.6	446.6	
137	Reg	NB	43	SX1	400	N020505	2	Express	ANA	5:05	SFT	8:19	3:14	30	8:49	0:44	14	8:19	9:03		446.6	893.2	0	
39	Reg	SB	43			S170903	17	S.Fernando Vly. Ltd	SFT	9:03	LAU	12:19	3:16	40	12:59	0:44	4	12:19	13:03		446.6	446.6	446.6	
201	Reg	NB	43			N161303	16	Central Vly. Ltd	LAU	13:03	SFT	16:21	3:18	30	16:51	0:39	9	16:21	17:00		446.6	446.6	0	
104	Reg	SB	43	X14	400	S011700	1	Bay Area Ltd	SFT	17:00	ANA	20:25	3:25	40	21:05	--	--	20:25	--		476.9	953.8	476.9	
140	Peak O/T	NB	44			N140519	14	LA-Merced	ANA	5:19	MCD	8:07	2:48	30	8:37	0:30	0	8:07	8:37		354.3	354.3	354.3	
151	Reg	NB	44			N150837	15	SF-Merced	MCD	8:37	SFT	10:11	1:34	40	10:51	0:27	(13)	10:11	10:38	*	161.2	161.2	161.2	
51	Reg	SB	44			S161038	16	Central Vly. Ltd	SFT	10:38	LAU	13:57	3:19	40	14:37	0:43	3	13:57	14:40		446.6	446.6	0	
213	Reg	NB	44			N171440	17	S.Fernando Vly. Ltd	LAU	14:40	SFT	17:56	3:16	30	18:26	0:18	(12)	17:56	18:14		446.6	446.6	446.6	
116	Reg	SB	44			S041814	4	All-Stop	SFT	18:14	ANA	22:17	4:03	40	22:57	--	--	22:17	--		476.9	476.9	476.9	
141	Reg	NB	45	X2	400	N010535	1	Bay Area Ltd	ANA	5:35	SFT	9:00	3:25	30	9:30	0:47	17	9:00	9:47		476.9	953.8	476.9	
44	Reg	SB	45			S150947	15	SF-Merced	SFT	9:47	MCD	11:21	1:34	40	12:01	0:41	1	11:21	12:02		161.2	161.2	161.2	
53	Reg	SB	45			S141202	14	LA-Merced	MCD	12:02	ANA	14:48	2:46	40	15:28	0:47	7	14:48	15:35		354.3	354.3	354.3	
224	Reg	NB	45	X3	400	N011535	1	Bay Area Ltd	ANA	15:35	SFT	19:00	3:25	30	19:30	--	--	19:00	--		476.9	953.8	476.9	
145	Peak O/T	NB	46		400	N040546	4	All-Stop	ANA	5:46	SFT	9:48	4:02	30	10:18	0:26	(4)	9:48	10:14		476.9	953.8	476.9	
49	Reg	SB	46			S041014	4	All-Stop	SFT	10:14	ANA	14:17	4:03	40	14:57	0:29	(11)	14:17	14:46	*	476.9	476.9	476.9	
219	Peak O/T	NB	46		400	N041446	4	All-Stop	ANA	14:46	SFT	18:48	4:02	30	19:18	0:26	(4)	18:48	19:14		476.9	953.8	476.9	
123	Night	SB	46			S041914	4	All-Stop	SFT	19:14	ANA	23:13	3:59	40	23:53	--	--	23:13	--		476.9	476.9	476.9	
146	Reg	NB	47	SX2	400	N020605	2	Express	ANA	6:05	SFT	9:19	3:14	30	9:49	0:49	19	9:19	10:08		446.6	893.2	0	
48	Reg	SB	47			S161008	16	Central Vly. Ltd	SFT	10:08	LAU	13:27	3:19	40	14:07	0:43	3	13:27	14:10		446.6	446.6	0	
210	Reg	NB	47			N171410	17	S.Fernando Vly. Ltd	LAU	14:10	SFT	17:26	3:16	30	17:56	0:34	4	17:26	18:00		446.6	446.6	446.6	
113	Reg	SB	47	X1	400	S011800	1	Bay Area Ltd	SFT	18:00	ANA	21:25	3:25	40	22:05	--	--	21:25	--		476.9	953.8	476.9	
149	Peak O/T	NB	48		400	N140619	14	LA-Merced	ANA	6:19	MCD	9:07	2:48	30	9:37	0:30	0	9:07	9:37		354.3	708.6	354.3	
160	Reg	NB	48			N150937	15	SF-Merced	MCD	9:37	SFT	11:11	1:34	40	11:51	0:27	(13)	11:11	11:38	*	161.2	161.2	161.2	
59	Reg	SB	48			S161138	16	Central Vly. Ltd	SFT	11:38	LAU	14:57	3:19	40	15:37	0:38	(2)	14:57	15:35		446.6	446.6	0	
222	Peak O/T	NB	48			N211535	21	S.Fernando Vly. Ltd	LAU	15:35	SFT	18:57	3:22	30	19:27	--	--	18:57	--		446.6	446.6	446.6	
150	Reg	NB	49	X3	400	N010635	1	Bay Area Ltd	ANA	6:35	SFT	10:00	3:25	30	10:30	0:47	17	10:00	10:47		476.9	953.8	476.9	
52	Reg	SB	49			S151047	15	SF-Merced	SFT	10:47	MCD	12:21	1:34	40	13:01	0:41	1	12:21	13:02		161.2	161.2	161.2	
61	Reg	SB	49			S141302	14	LA-Merced	MCD	13:02	ANA	15:48	2:46	40	16:28	0:47	7	15:48	16:35		354.3	354.3	354.3	
233	Reg	NB	49	X4	400	N011635	1	Bay Area Ltd	ANA	16:35	SFT	20:00	3:25	30	20:30	--	--	20:00	--		476.9	953.8	476.9	
153	Peak O/T	NB	50		400	N100642	10	Central Vly. Ltd Ext.	ANA	6:42	SFT	10:27	3:45	30	10:57	0:36	6	10:27	11:03		476.9	953.8	0	
55	Reg	SB	50			S171103	17	S.Fernando Vly. Ltd	SFT	11:03	LAU	14:19	3:16	40	14:59	0:44	4	14:19	15:03		446.6	446.6	446.6	
217	Peak O/T	NB	50			N191503	19	S.Fernando Vly. Ltd	LAU	15:03	SFT	18:15	3:12	30	18:45	0:32	2	18:15	18:47		446.6	446.6	446.6	
119	Reg	SB	50			S151847	15	SF-Merced	SFT	18:47	MCD	20:21	1:34	40	21:01	--	--	20:21	--		161.2	161.2	161.2	
154	Peak O/T	NB	51		400	N040646	4	All-Stop	ANA	6:46	SFT	10:48	4:02	30	11:18	0:26	(4)	10:48	11:14		476.9	953.8	476.9	
57	Reg	SB	51			S041114	4	All-Stop	SFT	11:14	ANA	15:17	4:03	40	15:57	0:29	(11)	15:17	15:46	*	476.9	476.9	476.9	
228	Peak O/T	NB	51		400	N041546	4	All-Stop	ANA	15:46	SFT	19:48	4:02	30	20:18	0:26	(4)	19:48	20:14		476.9	953.8	476.9	
127	Night	SB	51			S042014	4	All-Stop	SFT	20:14	ANA	0:13	3:59	40	0:53	--	--	0:13	--		476.9	476.9	476.9	
155	Reg	NB	52	SX3	400	N020705	2	Express	ANA	7:05	SFT	10:19	3:14	30	10:49	0:49	19	10:19	11:08		446.6	893.2	0	
56	Reg	SB	52			S161108	16	Central Vly. Ltd	SFT	11:08	LAU	14:27	3:19	40	15:07	0:40	0	14:27	15:07		446.6	446.6	0	

CALIFORNIA HIGH SPEED RAIL
APPENDIX A3 -- EQUIPMENT CYCLES -- PHASE 1 BASE SERVICE PLAN (Version 10)

ID	OvertkScheme	Dir	Set	Set2	Consist	Train No.	Pattern	Train Type	Orig	OrigTime	Dest	DestTime	RunTime	MinLay	Avail	Layover	Excess	DestArr	DestDep	T	TrnMi	200m SetMi	Wkend	Yd
218	Peak O/T	NB	52			N181507	18	Central Vly. Ltd	LAU	15:07	SFT	18:27	3:20	30	18:57	0:43	13	18:27	19:10		446.6	446.6	446.6	
122	Reg	SB	52			S171910	17	S.Fernando Vly. Ltd	SFT	19:10	LAU	22:26	3:16	40	23:06	--	--	22:26	--		446.6	446.6	446.6	
158	Reg	NB	53			N140720	14	LA-Merced	ANA	7:20	MCD	10:07	2:47	30	10:37	0:30	0	10:07	10:37		354.3	354.3	354.3	
168	Reg	NB	53			N151037	15	SF-Merced	MCD	10:37	SFT	12:11	1:34	40	12:51	0:27	(13)	12:11	12:38	*	161.2	161.2	161.2	
67	Reg	SB	53			S161238	16	Central Vly. Ltd	SFT	12:38	LAU	15:57	3:19	40	16:37	0:38	(2)	15:57	16:35		446.6	446.6	0	
231	Peak O/T	NB	53		400	N211635	21	S.Fernando Vly. Ltd	LAU	16:35	SFT	19:57	3:22	30	20:27	--	--	19:57	--		446.6	893.2	446.6	
159	Reg	NB	54	X4	400	N010735	1	Bay Area Ltd	ANA	7:35	SFT	11:00	3:25	30	11:30	0:47	17	11:00	11:47		476.9	953.8	476.9	
60	Reg	SB	54			S151147	15	SF-Merced	SFT	11:47	MCD	13:21	1:34	40	14:01	0:41	1	13:21	14:02		161.2	161.2	161.2	
69	Reg	SB	54			S141402	14	LA-Merced	MCD	14:02	ANA	16:48	2:46	40	17:28	0:47	7	16:48	17:35		354.3	354.3	354.3	
242	Reg	NB	54	X5	400	N011735	1	Bay Area Ltd	ANA	17:35	SFT	21:00	3:25	30	21:30	--	--	21:00	--		476.9	953.8	476.9	
163	Reg	NB	55		400	N040752	4	All-Stop	ANA	7:52	SFT	11:54	4:02	30	12:24	0:20	(10)	11:54	12:14	*	476.9	953.8	476.9	
65	Reg	SB	55			S041214	4	All-Stop	SFT	12:14	ANA	16:17	4:03	40	16:57	0:29	(11)	16:17	16:46	*	476.9	476.9	476.9	
237	Peak O/T	NB	55		400	N041646	4	All-Stop	ANA	16:46	SFT	20:48	4:02	30	21:18	0:26	(4)	20:48	21:14		476.9	953.8	476.9	
130	Night	SB	55			S042114	4	All-Stop	SFT	21:14	ANA	1:13	3:59	40	1:53	--	--	1:13	--		476.9	476.9	476.9	
166	Peak O/T	NB	56			N140820	14	LA-Merced	ANA	8:20	MCD	11:08	2:48	30	11:38	0:29	(1)	11:08	11:37		354.3	354.3	354.3	
176	Reg	NB	56			N151137	15	SF-Merced	MCD	11:37	SFT	13:11	1:34	40	13:51	0:27	(13)	13:11	13:38	*	161.2	161.2	161.2	
75	Reg	SB	56			S161338	16	Central Vly. Ltd	SFT	13:38	LAU	16:57	3:19	40	17:37	0:38	(2)	16:57	17:35		446.6	446.6	0	
240	Peak O/T	NB	56			N211735	21	S.Fernando Vly. Ltd	LAU	17:35	SFT	20:57	3:22	30	21:27	--	--	20:57	--		446.6	446.6	446.6	
167	Reg	NB	57	X5	400	N010835	1	Bay Area Ltd	ANA	8:35	SFT	12:00	3:25	30	12:30	0:47	17	12:00	12:47		476.9	953.8	476.9	
68	Reg	SB	57			S151247	15	SF-Merced	SFT	12:47	MCD	14:21	1:34	40	15:01	0:58	18	14:21	15:19		161.2	161.2	161.2	
79	Peak O/T	SB	57			S141519	14	LA-Merced	MCD	15:19	ANA	18:07	2:48	40	18:47	0:28	(12)	18:07	18:35		354.3	354.3	354.3	
250	Reg	NB	57	X11	400	N011835	1	Bay Area Ltd	ANA	18:35	SFT	22:00	3:25	30	22:30	--	--	22:00	--		476.9	953.8	476.9	
134	Peak O/T	NB	61			N190503	19	S.Fernando Vly. Ltd	LAU	5:03	SFT	8:15	3:12	30	8:45	0:32	2	8:15	8:47		446.6	446.6	446.6	
36	Reg	SB	61			S150847	15	SF-Merced	SFT	8:47	MCD	10:21	1:34	40	11:01	0:41	1	10:21	11:02		161.2	161.2	161.2	
45	Reg	SB	61			S141102	14	LA-Merced	MCD	11:02	ANA	13:48	2:46	40	14:28	0:47	7	13:48	14:35		354.3	354.3	354.3	
215	Reg	NB	61	X2	400	N011435	1	Bay Area Ltd	ANA	14:35	SFT	18:00	3:25	30	18:30	0:33	3	18:00	18:33		476.9	953.8	476.9	
117	Reg	SB	61			S171833	17	S.Fernando Vly. Ltd	SFT	18:33	LAU	21:49	3:16	40	22:29	--	--	21:49	--		446.6	446.6	446.6	
135	Peak O/T	NB	62			N180507	18	Central Vly. Ltd	LAU	5:07	SFT	8:27	3:20	30	8:57	0:33	3	8:27	9:00		446.6	446.6	446.6	
38	Reg	SB	62	X1	400	S010900	1	Bay Area Ltd	SFT	9:00	ANA	12:25	3:25	40	13:05	0:55	15	12:25	13:20		476.9	953.8	476.9	
206	Reg	NB	62			N141320	14	LA-Merced	ANA	13:20	MCD	16:07	2:47	30	16:37	0:30	0	16:07	16:37		354.3	354.3	354.3	
216	Reg	NB	62			N151637	15	SF-Merced	MCD	16:37	SFT	18:11	1:34	40	18:51	0:27	(13)	18:11	18:38		161.2	161.2	161.2	
118	Reg	SB	62			S161838	16	Central Vly. Ltd	SFT	18:38	LAU	21:57	3:19	40	22:37	--	--	21:57	--		446.6	446.6	0	
138	Peak O/T	NB	63			N200533	20	Central Vly. Ltd	LAU	5:33	SFT	8:51	3:18	30	9:21	0:17	(13)	8:51	9:08	*	446.6	446.6	446.6	
40	Reg	SB	63			S160908	16	Central Vly. Ltd	SFT	9:08	LAU	12:27	3:19	40	13:07	0:43	3	12:27	13:10		446.6	446.6	0	
202	Reg	NB	63			N171310	17	S.Fernando Vly. Ltd	LAU	13:10	SFT	16:26	3:16	30	16:56	0:38	8	16:26	17:04		446.6	446.6	446.6	
105	Peak O/T	SB	63		400	S191704	19	S.Fernando Vly. Ltd	SFT	17:04	LAU	20:15	3:11	40	20:55	--	--	20:15	--		446.6	893.2	446.6	
139	Peak O/T	NB	64			N210535	21	S.Fernando Vly. Ltd	LAU	5:35	SFT	8:57	3:22	30	9:27	0:36	6	8:57	9:33		446.6	446.6	446.6	
42	Reg	SB	64			S170933	17	S.Fernando Vly. Ltd	SFT	9:33	LAU	12:49	3:16	40	13:29	0:44	4	12:49	13:33		446.6	446.6	446.6	
204	Reg	NB	64			N161333	16	Central Vly. Ltd	LAU	13:33	SFT	16:51	3:18	30	17:21	0:17	(13)	16:51	17:08	*	446.6	446.6	0	
106	Peak O/T	SB	64			S181708	18	Central Vly. Ltd	SFT	17:08	LAU	20:34	3:26	40	21:14	--	--	20:34	--		446.6	446.6	446.6	
143	Peak O/T	NB	65			N190603	19	S.Fernando Vly. Ltd	LAU	6:03	SFT	9:15	3:12	30	9:45	0:45	15	9:15	10:00		446.6	446.6	446.6	
46	Reg	SB	65	X2	400	S011000	1	Bay Area Ltd	SFT	10:00	ANA	13:25	3:25	40	14:05	0:54	14	13:25	14:19		476.9	953.8	476.9	
214	Peak O/T	NB	65			N141419	14	LA-Merced	ANA	14:19	MCD	17:07	2:48	30	17:37	0:30	0	17:07	17:37		354.3	354.3	354.3	
225	Reg	NB	65			N151737	15	SF-Merced	MCD	17:37	SFT	19:11	1:34	40	19:51	--	--	19:11	--		161.2	161.2	161.2	
144	Peak O/T	NB	66			N180607	18	Central Vly. Ltd	LAU	6:07	SFT	9:27	3:20	30	9:57	0:36	6	9:27	10:03		446.6	446.6	446.6	
47	Reg	SB	66			S171003	17	S.Fernando Vly. Ltd	SFT	10:03	LAU	13:19	3:16	40	13:59	0:44	4	13:19	14:03		446.6	446.6	446.6	
209	Reg	NB	66			N161403	16	Central Vly. Ltd	LAU	14:03	SFT	17:21	3:18	30	17:51	0:26	(4)	17:21	17:47		446.6	446.6	0	
111	Reg	SB	66			S151747	15	SF-Merced	SFT	17:47	MCD	19:21	1:34	40	20:01	0:41	1	19:21	20:02		161.2	161.2	161.2	
120	Reg	SB	66			S142002	14	LA-Merced	MCD	20:02	ANA	22:48	2:46	40	23:28	--	--	22:48	--		354.3	354.3	354.3	YSF
147	Peak O/T	NB	67			N200633	20	Central Vly. Ltd	LAU	6:33	SFT	9:51	3:18	30	10:21	5:38	308	9:51	15:29		446.6	446.6	446.6	
90	Reg	SB	67	SX4	400	S021529	2	Express	SFT	15:29	ANA	18:43	3:14	40	19:23	0:52	12	18:43	19:35		446.6	893.2	0	
256	Reg	NB	67	X12	400	N011935	1	Bay Area Ltd	ANA	19:35	SFT	23:00	3:25	30	23:30	--	--	23:00	--		476.9	953.8	476.9	

CALIFORNIA HIGH SPEED RAIL
APPENDIX A3 -- EQUIPMENT CYCLES -- PHASE 1 BASE SERVICE PLAN (Version 10)

ID	OvertkScheme	Dir	Set	Set2	Consist	Train No.	Pattern	Train Type	Orig	OrigTime	Dest	DestTime	RunTime	MinLay	Avail	Layover	Excess	DestArr	DestDep	T	TrnMi	200m SetMi	Wkend	Yd
148	Peak O/T	NB	68		400	N210635	21	S.Fernando Vly. Ltd	LAU	6:35	SFT	9:57	3:22	30	10:27	0:36	6	9:57	10:33		446.6	893.2	446.6	
50	Reg	SB	68			S171033	17	S.Fernando Vly. Ltd	SFT	10:33	LAU	13:49	3:16	40	14:29	0:44	4	13:49	14:33		446.6	446.6	446.6	
212	Reg	NB	68			N161433	16	Central Vly. Ltd	LAU	14:33	SFT	17:51	3:18	30	18:21	0:17	(13)	17:51	18:08		446.6	446.6	0	
115	Reg	SB	68			S161808	16	Central Vly. Ltd	SFT	18:08	LAU	21:27	3:19	40	22:07	--	--	21:27	--		446.6	446.6	0	
152	Peak O/T	NB	69		400	N190703	19	S.Fernando Vly. Ltd	LAU	7:03	SFT	10:15	3:12	30	10:45	0:45	15	10:15	11:00		446.6	893.2	446.6	
54	Reg	SB	69	X3	400	S011100	1	Bay Area Ltd	SFT	11:00	ANA	14:25	3:25	40	15:05	0:54	14	14:25	15:19		476.9	953.8	476.9	
223	Reg	NB	69			N141519	14	LA-Merced	ANA	15:19	MCD	18:06	2:47	30	18:36	0:31	1	18:06	18:37		354.3	354.3	354.3	
234	Reg	NB	69			N151837	15	SF-Merced	MCD	18:37	SFT	20:11	1:34	40	20:51	--	--	20:11	--		161.2	161.2	161.2	YSF
156	Peak O/T	NB	70			N200733	20	Central Vly. Ltd	LAU	7:33	SFT	10:51	3:18	30	11:21	5:38	308	10:51	16:29		446.6	446.6	446.6	
99	Reg	SB	70	SX5	400	S021629	2	Express	SFT	16:29	ANA	19:43	3:14	40	20:23	0:52	12	19:43	20:35		446.6	893.2	0	
259	Reg	NB	70	X13	400	N012035	1	Bay Area Ltd	ANA	20:35	SFT	0:00	3:25	30	0:30	--	--	0:00	--		476.9	953.8	476.9	
157	Peak O/T	NB	71			N210735	21	S.Fernando Vly. Ltd	LAU	7:35	SFT	10:57	3:22	30	11:27	0:36	6	10:57	11:33		446.6	446.6	446.6	
58	Reg	SB	71			S171133	17	S.Fernando Vly. Ltd	SFT	11:33	LAU	14:49	3:16	40	15:29	0:44	4	14:49	15:33		446.6	446.6	446.6	
221	Peak O/T	NB	71			N201533	20	Central Vly. Ltd	LAU	15:33	SFT	18:51	3:18	30	19:21	0:44	14	18:51	19:35		446.6	446.6	446.6	
124	Reg	SB	71			S161935	16	Central Vly. Ltd	SFT	19:35	LAU	22:54	3:19	40	23:34	--	--	22:54	--		446.6	446.6	0	
161	Reg	NB	72			N160803	16	Central Vly. Ltd	LAU	8:03	SFT	11:21	3:18	30	11:51	0:39	9	11:21	12:00		446.6	446.6	0	
62	Reg	SB	72	X4	400	S011200	1	Bay Area Ltd	SFT	12:00	ANA	15:25	3:25	40	16:05	0:54	14	15:25	16:19		476.9	953.8	476.9	
232	Reg	NB	72			N141619	14	LA-Merced	ANA	16:19	MCD	19:06	2:47	30	19:36	0:31	1	19:06	19:37		354.3	354.3	354.3	
243	Reg	NB	72			N151937	15	SF-Merced	MCD	19:37	SFT	21:11	1:34	40	21:51	--	--	21:11	--		161.2	161.2	161.2	
162	Reg	NB	73			N170810	17	S.Fernando Vly. Ltd	LAU	8:10	SFT	11:26	3:16	30	11:56	0:37	7	11:26	12:03		446.6	446.6	446.6	
63	Peak O/T	SB	73			S171203	17	S.Fernando Vly. Ltd	SFT	12:03	LAU	15:19	3:16	40	15:59	0:44	4	15:19	16:03		446.6	446.6	446.6	
226	Peak O/T	NB	73			N191603	19	S.Fernando Vly. Ltd	LAU	16:03	SFT	19:15	3:12	30	19:45	0:32	2	19:15	19:47		446.6	446.6	446.6	
125	Reg	SB	73			S151947	15	SF-Merced	SFT	19:47	MCD	21:21	1:34	40	22:01	--	--	21:21	--		161.2	161.2	161.2	
164	Reg	NB	74			N160833	16	Central Vly. Ltd	LAU	8:33	SFT	11:51	3:18	30	12:21	0:17	(13)	11:51	12:08	*	446.6	446.6	0	
64	Reg	SB	74			S161208	16	Central Vly. Ltd	SFT	12:08	LAU	15:27	3:19	40	16:07	0:40	0	15:27	16:07		446.6	446.6	0	
227	Peak O/T	NB	74			N181607	18	Central Vly. Ltd	LAU	16:07	SFT	19:27	3:20	30	19:57	0:33	3	19:27	20:00		446.6	446.6	446.6	
126	Reg	SB	74	X3	400	S012000	1	Bay Area Ltd	SFT	20:00	ANA	23:25	3:25	40	0:05	--	--	23:25	--		476.9	953.8	476.9	
165	Reg	NB	75			N170840	17	S.Fernando Vly. Ltd	LAU	8:40	SFT	11:56	3:16	30	12:26	0:37	7	11:56	12:33		446.6	446.6	446.6	
66	Reg	SB	75			S171233	17	S.Fernando Vly. Ltd	SFT	12:33	LAU	15:49	3:16	40	16:29	0:44	4	15:49	16:33		446.6	446.6	446.6	
230	Peak O/T	NB	75			N201633	20	Central Vly. Ltd	LAU	16:33	SFT	19:51	3:18	30	20:21	--	--	19:51	--		446.6	446.6	446.6	
1	Night	SB	M1			S140519	14	LA-Merced	MCD	5:19	ANA	8:01	2:42	40	8:41	0:51	11	8:01	8:52		354.3	354.3	354.3	
171	Reg	NB	M1			N040852	4	All-Stop	ANA	8:52	SFT	12:54	4:02	30	13:24	0:20	(10)	12:54	13:14	*	476.9	476.9	476.9	
73	Reg	SB	M1			S041314	4	All-Stop	SFT	13:14	ANA	17:17	4:03	40	17:57	0:35	(5)	17:17	17:52		476.9	476.9	476.9	
01190	Reg	NB	M1			N041752	4	All-Stop	ANA	17:52	SFT	21:54	4:02	30	22:24	--	--	21:54	--		476.9	476.9	476.9	
4	Peak O/T	SB	M2		400	S140619	14	LA-Merced	MCD	6:19	ANA	9:07	2:48	40	9:47	0:45	5	9:07	9:52		354.3	708.6	354.3	
179	Reg	NB	M2			N040952	4	All-Stop	ANA	9:52	SFT	13:54	4:02	30	14:24	0:20	(10)	13:54	14:14	*	476.9	476.9	476.9	
81	Reg	SB	M2			S041414	4	All-Stop	SFT	14:14	ANA	18:17	4:03	40	18:57	0:35	(5)	18:17	18:52		476.9	476.9	476.9	
253	Night	NB	M2			N041852	4	All-Stop	ANA	18:52	SFT	22:51	3:59	30	23:21	--	--	22:51	--		476.9	476.9	476.9	
131	Reg	NB	M3			N150537	15	SF-Merced	MCD	5:37	SFT	7:11	1:34	40	7:51	0:52	12	7:11	8:03		161.2	161.2	161.2	
31	Reg	SB	M3			S170803	17	S.Fernando Vly. Ltd	SFT	8:03	LAU	11:19	3:16	40	11:59	0:44	4	11:19	12:03		446.6	446.6	446.6	
193	Reg	NB	M3			N161203	16	Central Vly. Ltd	LAU	12:03	SFT	15:21	3:18	30	15:51	0:39	9	15:21	16:00		446.6	446.6	0	
94	Reg	SB	M3	X13	400	S011600	1	Bay Area Ltd	SFT	16:00	ANA	19:25	3:25	40	20:05	0:55	15	19:25	20:20		476.9	953.8	476.9	
258	Reg	NB	M3			N142020	14	LA-Merced	ANA	20:20	MCD	23:07	2:47	30	23:37	--	--	23:07	--		354.3	354.3	354.3	
133	Reg	NB	M4			N150637	15	SF-Merced	MCD	6:37	SFT	8:11	1:34	40	8:51	0:27	(13)	8:11	8:38	*	161.2	161.2	161.2	
35	Reg	SB	M4			S160838	16	Central Vly. Ltd	SFT	8:38	LAU	11:57	3:19	40	12:37	0:43	3	11:57	12:40		446.6	446.6	0	
197	Reg	NB	M4			N171240	17	S.Fernando Vly. Ltd	LAU	12:40	SFT	15:56	3:16	30	16:26	0:37	7	15:56	16:33		446.6	446.6	446.6	
100	Peak O/T	SB	M4		400	S211633	21	S.Fernando Vly. Ltd	SFT	16:33	LAU	19:51	3:18	40	20:31	--	--	19:51	--		446.6	893.2	446.6	
13	Peak O/T	SB	M5			S140719	14	LA-Merced	MCD	7:19	ANA	10:07	2:48	40	10:47	0:45	5	10:07	10:52		354.3	354.3	354.3	
187	Reg	NB	M5			N041052	4	All-Stop	ANA	10:52	SFT	14:54	4:02	30	15:24	0:20	(10)	14:54	15:14	*	476.9	476.9	476.9	
89	Peak O/T	SB	M5		400	S041514	4	All-Stop	SFT	15:14	ANA	19:19	4:05	40	19:59	--	--	19:19	--		476.9	953.8	476.9	
142	Reg	NB	M6			N150737	15	SF-Merced	MCD	7:37	SFT	9:11	1:34	40	9:51	0:27	(13)	9:11	9:38	*	161.2	161.2	161.2	
43	Reg	SB	M6			S160938	16	Central Vly. Ltd	SFT	9:38	LAU	12:57	3:19	40	13:37	0:43	3	12:57	13:40		446.6	446.6	0	

**CALIFORNIA HIGH SPEED RAIL
APPENDIX A3 -- EQUIPMENT CYCLES -- PHASE 1 BASE SERVICE PLAN (Version 10)**

ID	OvertrScheme	Dir	Set	Set2	Consist	Train No.	Pattern	Train Type	Orig	OrigTime	Dest	DestTime	RunTime	MinLay	Avail	Layover	Excess	DestArr	DestDep	T	TrnMi	200m SetMi	Wkend	Yd
205	Reg	NB	M6			N171340	17	S.Fernando Vly. Ltd	LAU	13:40	SFT	16:56	3:16	30	17:26	0:37	7	16:56	17:33		446.6	446.6	446.6	
109	Peak O/T	SB	M6			S211733	21	S.Fernando Vly. Ltd	SFT	17:33	LAU	20:51	3:18	40	21:31	--	--	20:51	--		446.6	446.6	446.6	

*Additional 200m trainsets available for these equipment turns◀

Totals

2,037	106211	140405	83760
-------	--------	--------	-------

	<u>Weekday</u>	<u>Weekend</u>
Days/yr	250	115
Ann miles	35101	9632
Ann miles	44,734	

[B] – VARIATION, WITH 1.0-3.5% RECOVERY TIME ALLOWANCE

Appendix B presents the characteristics of a variation of the California High-Speed Train (HST) Phase 1 Service Plan, which assumes a lower and more aggressive allowance for schedule pad or recovery time, consistent with the intent of the HST system to operate at a very high level of precision. In this variation of the service plan, the express services operating between San Francisco and Los Angeles with one intermediate stop at San Jose would have a scheduled run time of 2 hours and 40 minutes, with a recovery time allowance of one percent. All other trains in this variation of the plan would have a recovery time allowance of three and one half percent.

In this versionsn of the service plan, the train stopping patterns, hours of service, and service frequencies were kept essentially the same as that of the base service plan described in Appendix A. Certain changes were made to the assumptions and general principles to allow for the marginally faster travel times estimated for the “express” trains:

- Recovery time incorporated in the end-to-end train running times was reduced from 7 percent to 1 percent for “express” trains and to 3.5 percent for all other train types
- The minimum headway between trains following each other past a given point was kept at 3 minutes except for sections north of San Jose and near each terminal location, which includes San Francisco-Transbay, Los Angeles Union Station, Anaheim, and Merced stations, because it was assumed that the rate in which trains would arrive and depart these locations could support a minimum headway of no less than 2 minutes.
- In addition to the standard 1 to 3.5 percent recovery time applied to all trains, additional recovery was added to certain trains to adjust the running time so as to avoid the overtakes and to maintain the minimum spacing between trains. This is described in more detail in the *New Service Sequence* section of this memorandum.
- To further reduce the estimated travel time, station dwell times at intermediate stops were reduced from two minutes to 90 seconds at San Jose and Los Angeles Union Station, and from 90 seconds to 75 seconds at all other intermediate stops.
- While the original baseline timetable presented clock face scheduling, the reduction of the amount of recovery time in this iteration resulted in departure times that do not allow for maintaining the clock face structure as long as the stopping patterns of each service type are kept the same as in the baseline timetable.

This variation of the Phase 1 service plan for the initial operating segment between Anaheim, Los Angeles and San Francisco was composed of the following train types and service patterns:

1. San Francisco-Los Angeles-Anaheim “Express” service (Pattern #1)
 - Clockface departure on the hour southbound from San Francisco between 5:00 AM and 9:00 PM
 - Clockface hourly departures northbound from Anaheim at 35 minutes past the hour, and departures from Los Angeles at the “top of the hour”.
 - During the peak period, northbound departures at Los Angeles were changed to 59 minutes past the hour to create time slots for local and limited-stop trains in order to minimize the overtakes.

2. San Francisco-Los Angeles-Anaheim “Express” service (Pattern #2)
 - Southbound trains depart San Francisco at 5:30 AM, 6:30 AM, 7:30 AM, 3:30 PM, 4:30 PM, and 5:30 PM.
 - Northbound trains depart Anaheim at 5:05 AM, 6:05 AM, 7:05 AM, 3:05 PM, 4:05 PM, and 6:05 PM so that the trains can depart Los Angeles at the “bottom” (:30) of the hour.
3. San Fernando Valley Off-peak Limited – Limited stop service between San Francisco and Los Angeles stopping at stations in the San Fernando Valley and the Santa Clara/Silicon Valley area, while generally bypassing Central Valley stations (Pattern #17)
 - 30-minute headways in both direction for travel between 8:00 AM and 3:00 PM, and again between 6:00 PM and 9:00 PM.
 - Southbound departure from San Francisco at :03 and :33 of the hour; northbound departure from Los Angeles at :10 and :40 of the hour.
 - No overtakes occur en route
 - Two northbound trips, departing Los Angeles at 8:10 AM and 9:10 AM, provide service to the Milbrae station.
 - Northbound trains departing Los Angeles at :40 of the hour reduce speed between Palmdale and Bakersfield to increase travel time by 2 minutes in order to minimize the dwell time of local trains overtaken at Bakersfield.
 - Reduced service to 60-minute headways after 7:00 PM
4. San Fernando Valley Peak Limited – Peak-only Limited stop service between San Francisco and Los Angeles stopping at stations in the San Fernando Valley and the Santa Clara/Silicon Valley area, while generally bypassing Central Valley stations (Patterns #19 and 21).
 - Two trains per hour per direction with combined 28 to 32 minute headways during the peak period.
 - Southbound departures from San Francisco at :03 of the hour (Pattern #19) and :33 of the hour (Pattern #21); Northbound departures from Los Angeles at :03 of the hour (Pattern #19) and :35 of the hour (Pattern #21)
 - No overtakes occur en route
5. Central Valley Off-peak Limited – Limited stop service between San Francisco and Los Angeles stopping at all stations north of Bakersfield while skipping all San Fernando Valley stations (Pattern #16).
 - 30-minute headways in both directions for travel between 8:00 AM and 3:00 PM, and again between 6:00 PM and 9:00 PM.
 - Southbound departure from San Francisco at :08 and :38 of the hour; northbound departure from Los Angeles at :03 and :33 of the hours
 - No overtakes occur en route

- Southbound trains departing San Francisco at :08 of the hour reduce speed between Bakersfield and Los Angeles to increase travel time by 5 to 10 minutes in order to avoid an overtake.
 - Reduced service to 60-minute headways after 7:00 PM
6. Central Valley Peak Limited – Limited stop service between San Francisco and Los Angeles stopping at all stations in the Central Valley and the north while making limited stops in the San Fernando Valley (Patterns #10, 18, and 20)
- Two trains per hour per direction with 28 to 32 minute headways during peak period
 - Southbound departure from San Francisco at :08 of the hour (Pattern #10/18) and :39 of the hour (Pattern #20); Northbound departure from Los Angeles at :06 of the hour (Pattern #10) or :07 of the hour (Pattern #19) and :33 of the hour (Pattern #21)
 - Two roundtrips in each direction are extended to Anaheim
 - Southbound trains departing San Francisco at :08 of the hour are overtaken by Express trains (Pattern #2) at Fresno
 - Northbound trains departing Los Angeles at :06 or :07 of the hour are overtaken by Express trains (Pattern #2) at Fresno
 - Some southbound trains reduce speed between Bakersfield and Los Angeles in order to avoid an overtake.

7. Local service, making all stops between San Francisco and Anaheim (Pattern #4)

- All day, hourly service with semi-clockface schedule.
- Southbound departure from San Francisco at :14 of the hour during peak period, :15 of the hour during off-peak period; northbound departure from Anaheim at :46 of the hour during peak period, :40 of the hour during off-peak period (departure at Los Angeles at :10 and :06 of the hour, respectively)
- During the peak period, southbound trains are overtaken twice by Express trains (Pattern #2) at Gilroy and by San Fernando Valley Limited trains at Fresno; while northbound trains are overtaken once by Express trains (Pattern #2) at Bakersfield
- During off-peak period, both southbound and northbound trains are overtaken once by San Fernando Valley Limited trains at Bakersfield
- All trains during mid-day period are overtaken once by San Fernando Valley Limited trains at Bakersfield

8. Merced-Los Angeles Local (Pattern #14)

- All day, hourly service with semi-clockface schedule
- Southbound departure from Merced at :05 of the hour throughout the day; northbound departure from Anaheim at :17 of the hour during peak period, :12 of the hour during off-peak period (departure at Los Angeles at :41 and :36 of the hour, respectively)

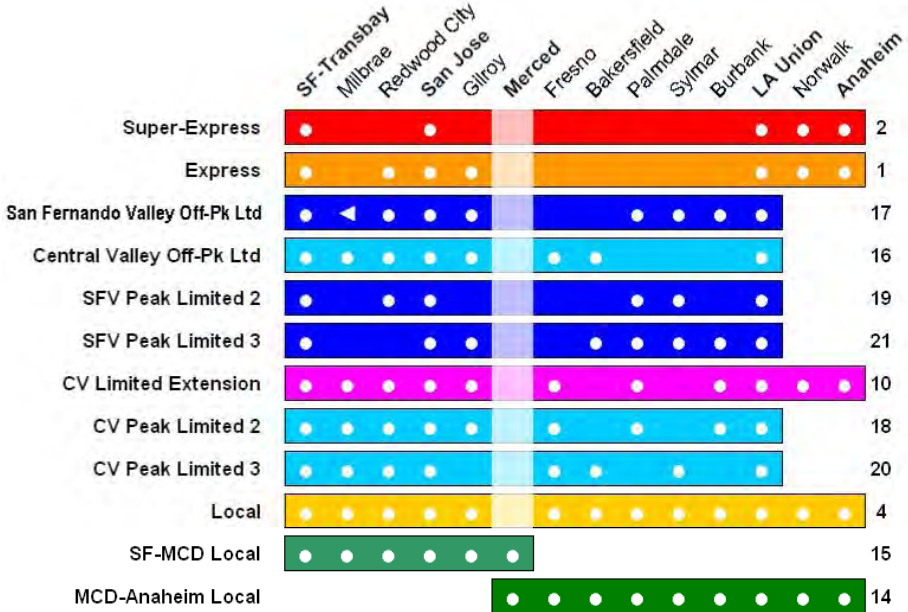
- During peak period, southbound trains have overtakes by Express (Pattern #1) and San Fernando Valley Limited trains at Fresno and Express trains (Pattern #2) at Bakersfield while northbound trains are overtaken once by Express trains (Pattern #1) at Bakersfield
- During off-peak periods, all trains have overtakes: (by San Fernando Valley Limited and Express trains (Pattern #1); northbound at Bakersfield and southbound at Fresno)
- Southbound trains arrive at Los Angeles Union Station before the following Central Valley Limited trains

9. San Francisco-Merced local service (Pattern #15)

- All-day, hourly service with semi-clockface schedule
- Southbound departure from San Francisco at :47 of the hour throughout the day; northbound departure from Merced at :34 of the hour during peak period and :37 of the hour during off-peak period
- No overtakes occur en route

Stations served by each stopping pattern are illustrated in the chart provided below:

Stopping Pattern in Revised (with reduced recovery time) Phase 1 Service Plan



Note: Trains make a stop at station with white circle; ◀: Special stop (northbound only).

This schedule variation provides a total of 260 revenue trips, the same number of trips assumed in the base plan. Since both service plans follow the same planning principles, the breakdown of the levels of service in each time period of the day is identical between them. This is illustrated in the revised timetable and time-distance chart presented in the Appendices B1 and B2.

As a result of reducing the recovery and station dwell times, it is estimated that Express trains (Pattern #2) can complete the travel between San Francisco and Los Angeles within 2 hours and 40 minutes. This reduction in the recovery and dwell times also improves the travel time of most of the projected 260 revenue trips in this service plan.

A hypothetical daily timetable for this service plan is presented in Appendix B1. This same schedule is presented in stringline (time-distance) diagram format in Appendix B2. Equipment cycles and the number of required trainsets will be the same in this scenario as in the base plan documented in Appendix A3, so a separate analysis of equipment cycles is not shown for the service plan variation.

This page is intentionally kept blank to facilitate double-sided printing.

B1. Hypothetical Timetable

This page is intentionally kept blank to facilitate double-sided printing.

VARIATION SERVICE PLAN

VARIATION SERVICE PLAN

Turns from →

APPENDIX B1

[illegible]

CALIFORNIA HIGH-SPEED RAIL
PHASE 1 TIMETABLE

VARIATION SERVICE PLAN

Turns from →																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
APPENDIX B1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
	Direction →	SB	SB	SB	SB	Mid 1	Reg	SB	SB	Mid 2	Reg	SB	SB	Peak O/T	Reg	SB	SB	Peak Ext	Peak O/T	Peak	SB	SB	Peak	Reg	SB	Peak O/T	Reg	SB	Peak	SB	Peak	Reg	SB	Peak O/T	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak	Reg	SB	Peak	SB	Peak

CALIFORNIA HIGH-SPEED RAIL
PHASE 1 TIMETABLE

VARIATION SERVICE PLAN

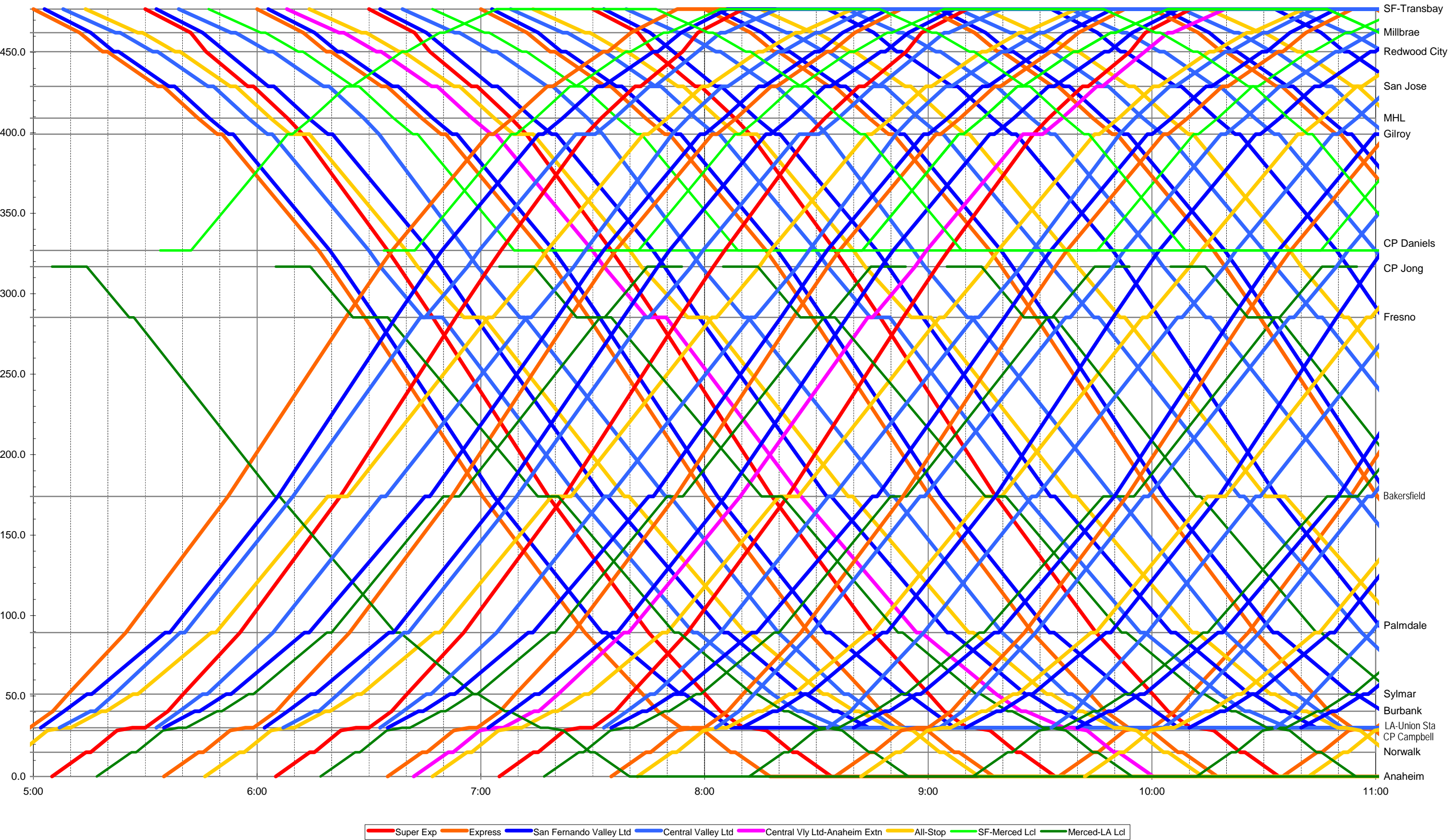
APPENDIX B1		Turns from →																			
		Direction →	Reg	Mid 1	Reg	Reg	Mid 2	Reg	Night O/T	Reg	Reg	Night	Mid 1	Reg	Reg	Night	Reg	Night			
		Trainset	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB			
		Train No. →	42	68	44	61	62	50	66	11	52	46	71	73	74	51	3	20	55		
Southbound		Pattern →	S171803	S161808	S041815	S171833	S161838	S151847	S142005	S011900	S171910	S041914	S161935	S151947	S012000	S042014	S152047	S012100	S042114		
		Service Type →	17	16	4	17	16	15	14	1	17	4	16	15	1	4	15	1	4		
		S.Fern'do Valley Limited	Central Valley Limited	All-Stop Local	S.Fern'do Valley Limited	Central Valley Limited	S.F. - Merced Local	L.A. - Merced Local	Bay Area Limited	S.Fern'do Valley Limited	All-Stop Local	Central Valley Limited	S.F. - Merced Local	Bay Area Limited	All-Stop Local	S.F. - Merced Local	Bay Area Limited	All-Stop Local			
		Mile	Station																		
		0.0 SFT	S.F.-Transbay	Dep	18:03	18:08	18:15	18:33	18:38	18:47		19:00	19:10	19:14	19:35	19:47	20:00	20:14	20:47	21:00	21:14
		14.7 SFO	Millbrae	Dep		18:23	18:30		18:53	19:02		---		19:29	19:50	20:02	---	20:29	21:02	---	21:29
		26.4 RWC	Redwood City	Dep	18:23	18:33	18:40	18:53	19:03	19:12		19:20	19:30	19:39	20:00	20:12	20:20	20:39	21:12	21:20	21:39
		48.0 SJC	San Jose	Dep	18:38	18:48	18:55	19:08	19:18	19:27		19:34	19:45	19:54	20:15	20:27	20:34	20:54	21:27	21:34	21:54
		77.7 GLY	Gilroy	Arr																	
				Dep	18:53	19:04	19:11	19:23	19:34	19:43		19:50	20:00	20:10	20:31	20:43	20:50	21:10	21:43	21:50	22:10
		187.5 MCD	Merced	Arr		↓	↓		↓	20:17			↓	↓	21:17		↓	22:17		↓	
		--		Dep						20:05											
		191.5 FNO	Fresno	Arr						20:25											
				Dep		19:45	19:52			20:30			20:51	21:12			21:51			22:51	
		302.8 BFD	Bakersfield	Arr			20:30			21:08											
				Dep		20:24	20:35			21:13			21:30	21:51			22:30			23:30	
		387.4 PMD	Palmdale	Arr	↓			↓				↓									
				Dep	20:33		21:09	21:03		21:45		21:40	22:03				23:03			0:03	
		425.7 SYL	Sylmar	Dep	20:54		21:30	21:24		22:06		22:01	22:24				23:24			0:24	
		436.3 BUR	Burbank	Arr		↓		↓				↓									
				Dep	21:03		21:38	21:33	↓	22:14		22:10	22:32		↓		23:32		↓	0:32	
		446.6 LAU	L.A. Union Sta.	Arr	21:11	21:25	21:46	21:41	21:49	22:23	21:53	22:18	22:40	22:52	22:53	23:40		23:53	0:40		
				Dep			21:48			22:25	21:55		22:42		22:55	23:42		23:55	0:42		
		461.8 NSF	Norwalk	Arr			22:00			22:37	22:07		22:55		23:07	23:55		0:07	0:55		
		476.9 ANA	Anaheim	Arr			22:10			22:46	22:17		23:04		23:17	0:04		0:17	1:04		
		Available →			21:51	22:05	22:50	22:21	22:29	20:57	23:26	22:57	22:58	23:44	23:32	21:57	23:57	0:44	22:57	0:57	1:44
		Turns for →																			
Northbound		Turns from →																			
		Direction →	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Reg	Night	Reg	Reg	Reg	Night	Night O/T	Reg	Night		
		Trainset	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB		
		Train No. →	4	14	M1	15	10	1	2	57	19	M2	18	23	67	5	M3	70	13		
		Pattern →	N161803	N171810	N041746	N161833	N141812	N171840	N152034	N011835	N161913	N041855	N141912	N171940	N011935	N041955	N142020	N012035	N042055		
		Service Type →	16	17	4	16	14	17	15	1	16	4	14	17	1	4	14	1	4		
			Central Valley Limited	S.Fern'do Valley Limited	All-Stop Local	Central Valley Limited	Merced Local	S.Fern'do Valley Limited	S.F. - Merced Local	Bay Area Limited	Central Valley Limited	All-Stop Local	Merced Local	S.Fern'do Valley Limited	Bay Area Limited	All-Stop Local	L.A. - Merced Local	Bay Area Limited	All-Stop Local		
		Mile	Station																		
		0.0 ANA	Anaheim	Dep			17:46		18:12		18:35		18:55	19:12		19:35	19:55	20:20	20:35	20:55	
		15.0 NSF	Norwalk	Dep			17:56		18:22		18:45		19:05	19:22		19:45	20:05	20:30	20:45	21:05	
		30.3 LAU	L.A. Union Sta.	Arr			18:08		18:34		18:56		19:17	19:34		19:56	20:17	20:42	20:56	21:17	
				Dep	18:03	18:10	18:10	18:33	18:36	18:40		19:00	19:13	19:19	19:36	19:40	20:00	20:19	20:44	21:00	21:19
		40.6 BUR	Burbank	Dep		18:19	18:18		18:45	18:49			19:29	19:45	19:49		20:29	20:53		21:29	
		51.1 SYL	Sylmar	Dep		18:28	18:19		18:54	18:58			19:37	19:54	19:58		20:37	21:02		21:37	
		89.4 PMD	Palmdale	Arr													21:21				
				Dep	↓	18:48	18:28	↓	19:14	19:18		↓	19:58	20:14	20:18		20:58	21:27		21:58	
		174.1 BFD	Bakersfield	Arr			19:19		19:47					20:47							
				Dep	18:58		19:24	19:28	19:55			20:08	20:29	20:55			21:29	21:58		22:29	
		285.4 FNO	Fresno	Arr																	
				Dep	19:37		20:03	20:07	20:34			20:47	21:08	21:34			22:08	22:37		23:08	
		354.4 MCD	Merced	Arr	↓		↓		20:58		↓	↓	↓	21:58		↓		22:57		↓	
		--		Dep						20:34		↓	↓	↓		↓					
		399.2 GLY	Gilroy	Arr																	
				Dep	20:18	20:31	20:44	20:48		20:59	21:09	21:04	21:28	21:50		21:59	22:04	22:50		23:04	23:50
		428.8 SJC	San Jose	Dep	20:34	20:47	21:00	21:04		21:15	21:25	21:20	21:44	22:05		22:15	22:20	23:05		23:20	0:05
		450.5 RWC	Redwood City	Arr	20:48	21:00	21:14	21:18		21:28	21:40	21:34	21:58	22:19		22:28	22:34	23:19		23:34	0:19
		462.2 SFO	Millbrae	Arr	---	---	21:24	---		---	21:50	---	---	22:29		---	---	23:29		---	0:29
		476.9 SFT	S.F.-Transbay	Arr	21:12	21:20	21:39	21:42		21:48	22:04	21:53	22:22	22:44		22:48	22:53	23:44		23:53	0:44
		Available →			21:42	21:50	22:09	22:12	21:38	22:18	22:34	22:23	22:52	23:14	22:38	23:18	23:23	0:14	23:37	0:23	1:14
		Turns for →																			

B2. Stringline Diagrams

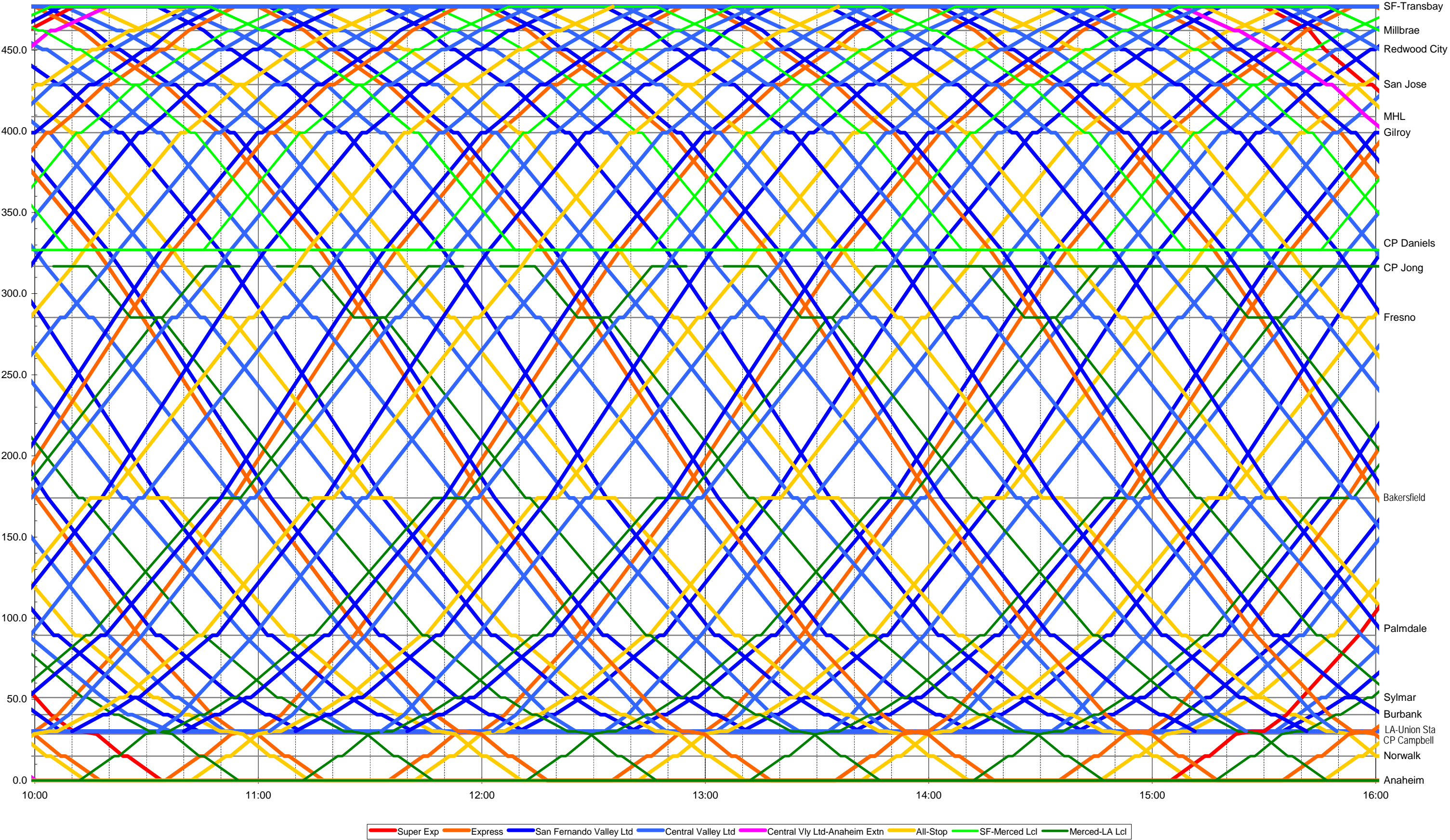
- Morning Peak Period
- Mid-Day Period
- Afternoon Peak Period
- Evening and Late Night Period

This page is intentionally kept blank to facilitate double-sided printing.

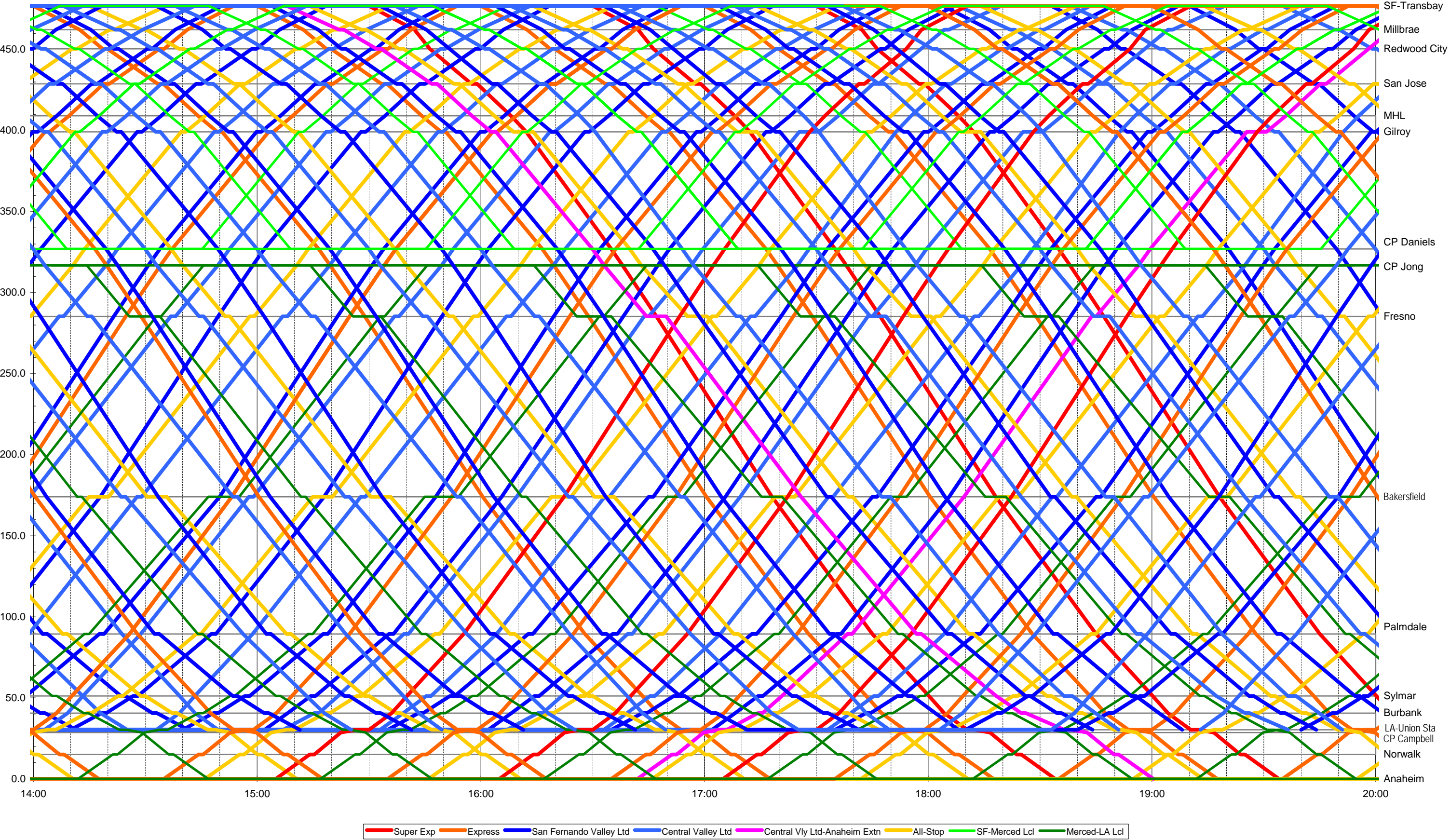
Appendix B2 - HSR PHASE 1 SERVICE PLAN - VARIATION (Version 10B) - MORNING PEAK



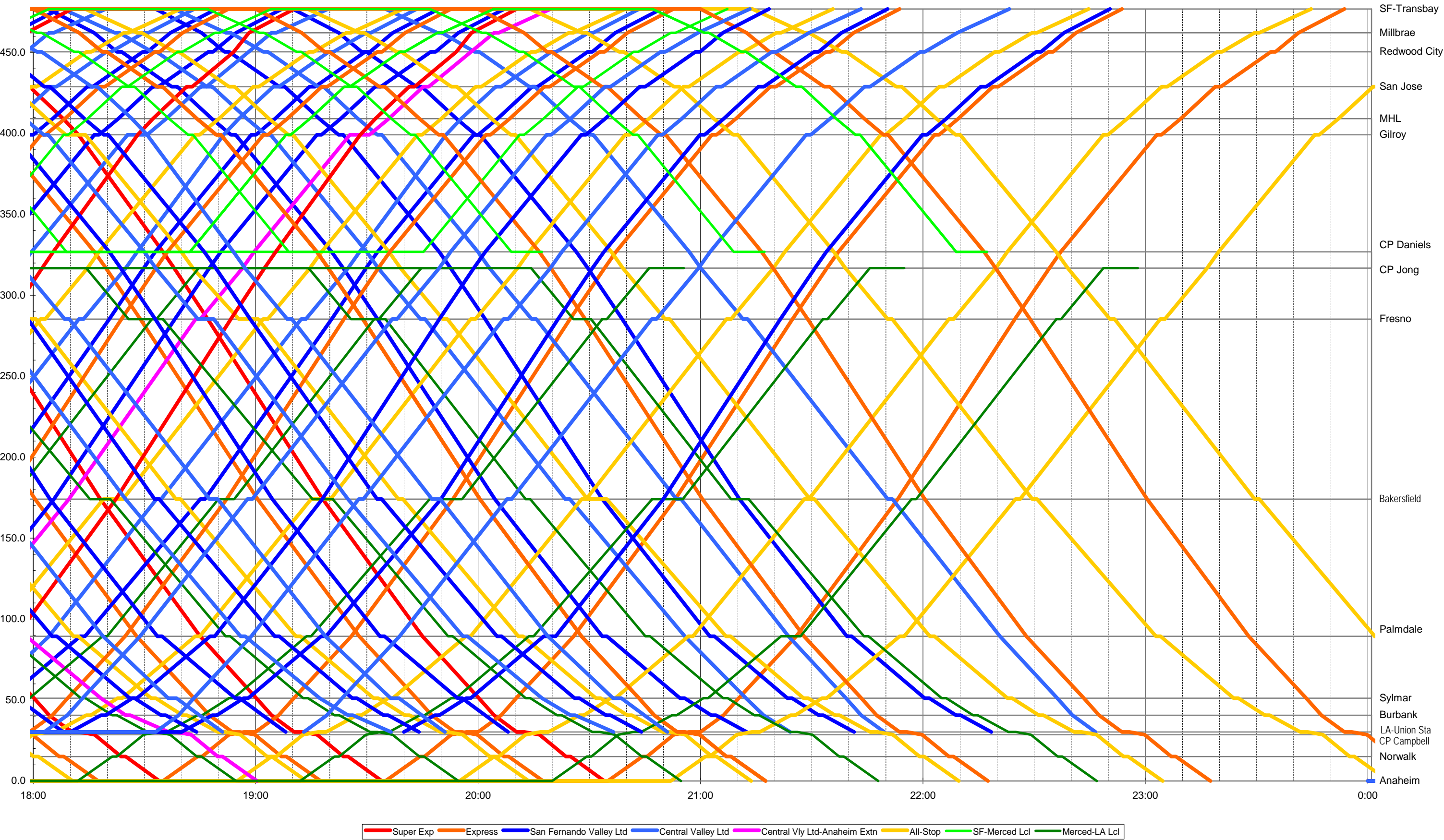
Appendix B2 - HSR PHASE 1 SERVICE PLAN - VARIATION (Version 10B) - MID-DAY



Appendix B2 - HSR PHASE 1 SERVICE PLAN - VARIATION (Version 10B) - AFTERNOON PEAK



Appendix B2 - HSR PHASE 1 SERVICE PLAN - VARIATION (Version 10B) - LATE EVENING





BOARD OF DIRECTORS 2010

SEAN ELSBERND, CHAIR
MARK CHURCH, VICE CHAIR
OMAR AHMAD
JOSE CISNEROS
NATHANIEL P. FORD, SR.
DON GAGE
ASH KALRA
ARTHUR L. LLOYD
KEN YEAGER

MICHAEL J. SCANLON
EXECUTIVE DIRECTOR

February 4, 2010

PRP-1802-LTO-PB-001

Mr. Dominic Spaethling
Parsons Brinkerhoff
303 Second Street, Suite 700 N
San Francisco, CA 94107

Subject: Caltrain Operations Schedule
CHSR Planning

Dominic,

At your request, Caltrain is transmitting for your use the 2025 Caltrain 10 train per peak hour Timetable. A few words concerning this timetable. The timetable assumes existing Caltrain operating speeds and station to station run times have not been vetted. The schedule is intended as a planning tool to assist PB in developing the CHSR Operations Plan and Schedule within the shared corridor. Caltrain is providing this information with the understanding that it is subject to changes in future Caltrain operational requirements or planning strategies. If such changes to the planned schedule occur, then Caltrain expects that CHSR will consequently adjust its Operations Plan as required to coordinate with Caltrain.

Sincerely,


Michelle Bouchard *for*
Director
Caltrain Rail Transportation

CC: R. Doty, PRP; Doc. Control

Enc: Caltrain 2025 Operations Schedule

PENINSULA CORRIDOR JOINT POWERS BOARD
1250 San Carlos Avenue – P.O. Box 3006
San Carlos, CA 94070-1306 (650)508-6269

10 Train Per Hour Schedule - With Transbay
EMU: Limited/Locals

Northbound

Tamien		5:02a	5:57a	6:15a			6:27a			6:45a			6:57a			7:15a			7:27a			7:45a			7:57a			8:15a			8:27a			8:45a		
San Jose Diridon	4:30a	5:05a	6:00a	6:06a	6:12a	6:18a	6:24a	6:30a	6:36a	6:42a	6:48a	6:54a	7:00a	7:06a	7:12a	7:18a	7:24a	7:30a	7:36a	7:42a	7:48a	7:54a	8:00a	8:06a	8:12a	8:18a	8:24a	8:30a	8:36a	8:42a	8:48a	8:54a				
College Park																						7:57a														
Santa Clara	4:35a	5:10a	6:05a		6:17a		6:29a	6:35a		6:47a		6:59a	7:05a		7:17a		7:29a	7:35a		7:47a		8:00a	8:05a		8:17a		8:29a	8:35a		8:47a		8:59a				
Lawrence	4:39a	5:14a		6:14a		6:26a	6:33a		6:44a		6:56a	7:03a		7:14a		7:26a	7:33a		7:44a		7:56a	8:04a		8:14a		8:26a	8:33a		8:44a		8:56a	9:03a				
Sunnyvale	4:42a	5:17a	6:11a	6:17a		6:29a		6:41a	6:47a		6:59a		7:11a	7:17a		7:29a		7:41a	7:47a		7:59a		8:11a	8:17a		8:29a		8:41a	8:47a		8:59a					
Mountain View	4:47a	5:22a	6:16a		6:26a	6:34a	6:40a	6:46a		6:56a	7:04a	7:10a	7:16a		7:26a	7:34a	7:40a	7:46a		7:56a	8:04a	8:11a	8:16a		8:26a	8:34a	8:40a	8:46a		8:56a	9:04a	9:10a				
San Antonio	4:50a	5:25a		6:24a	6:29a				6:54a	6:59a				7:24a	7:29a				7:54a	7:59a					8:24a	8:29a			8:54a	8:59a						
California Avenue	4:53a	5:28a		6:27a	6:32a				6:57a	7:02a				7:27a	7:32a				7:57a	8:02a					8:27a	8:32a			8:57a	9:02a						
Palo Alto	4:57a	5:32a	6:23a	6:31a	6:36a	6:41a	6:47a	6:53a	7:01a	7:06a	7:11a	7:17a	7:23a	7:31a	7:36a	7:41a	7:47a	7:53a	8:01a	8:06a	8:11a	8:18a	8:23a	8:31a	8:36a	8:41a	8:47a	8:53a	9:01a	9:06a	9:11a	9:17a				
Menlo Park	4:59a	5:34a		6:33a		6:43a	6:49a		7:03a		7:13a	7:19a		7:33a		7:43a	7:49a		8:03a		8:13a	8:20a		8:33a		8:43a	8:49a		9:03a		9:13a	9:19a				
Atherton	5:01a	5:36a	6:26a					6:56a					7:26a					7:56a				8:26a						8:56a								
Redwood City	5:05a	5:40a	6:30a		6:41a	6:49a	6:54a	7:00a		7:11a	7:19a	7:24a	7:30a		7:41a	7:49a	7:54a	8:00a		8:11a	8:19a	8:25a	8:30a		8:41a	8:49a	8:54a	9:00a		9:11a	9:19a	9:24a				
San Carlos	5:08a	5:43a	6:33a		6:44a		6:57a	7:03a		7:14a		7:27a	7:33a		7:44a		7:57a	8:03a		8:14a	8:28a		8:33a		8:44a		8:57a	9:03a		9:14a		9:27a				
Belmont	5:10a	5:45a		6:40a	6:46a				7:10a	7:16a				7:40a	7:46a				8:10a	8:16a					8:40a	8:46a			9:10a	9:16a						
Hillsdale	5:13a	5:48a	6:37a	6:43a	6:49a	6:54a	7:01a	7:07a	7:13a	7:19a	7:24a	7:31a	7:37a	7:43a	7:49a	7:54a	8:01a	8:07a	8:13a	8:19a	8:24a	8:32a	8:37a	8:43a	8:49a	8:54a	9:01a	9:07a	9:13a	9:19a	9:24a	9:31a				
Hayward Park	5:15a	5:50a				6:56a					7:26a					7:56a					8:26a						8:56a			9:26a						
San Mateo	5:17a	5:52a		6:46a		6:58a	7:04a		7:16a		7:28a	7:34a		7:46a		7:58a	8:04a		8:16a		8:28a	8:35a			8:46a		8:58a	9:04a		9:16a		9:28a	9:34a			
Burlingame	5:20a	5:55a	6:41a		6:53a			7:11a		7:23a			7:41a		7:53a			8:11a		8:23a			8:41a		8:53a			9:11a		9:23a						
Broadway	5:22a	5:57a	6:43a					7:13a					7:43a				8:13a					8:43a						9:13a								
Millbrae	5:26a	6:01a	6:47a	6:52a	6:58a	7:04a	7:10a	7:17a	7:22a	7:28a	7:34a	7:40a	7:47a	7:52a	7:58a	8:04a	8:10a	8:17a	8:22a	8:28a	8:34a	8:41a	8:47a	8:52a	8:58a	9:04a	9:10a	9:17a	9:22a	9:28a	9:34a	9:40a				
San Bruno	5:30a	6:05a		6:56a			7:14a		7:26a			7:44a		7:56a			8:14a		8:26a			8:45a			8:56a			9:14a		9:26a		9:44a				
So. San Francisco	5:34a	6:09a	6:54a			7:11a	7:18a	7:24a			7:41a	7:48a	7:54a		8:11a	8:18a	8:24a			8:41a	8:49a	8:54a			9:11a	9:18a	9:24a				9:41a	9:48a				
Bayshore	5:39a	6:14a			7:08a	7:16a				7:38a	7:46a				8:08a	8:16a				8:38a	8:46a				9:08a		9:16a			9:38a	9:46a					
22nd Street	5:44a	6:19a		7:06a	7:13a				7:36a	7:43a				8:06a	8:13a				8:36a	8:43a				9:06a	9:13a				9:36a	9:43a						
4th & King	5:48a	6:23a	7:05a	7:10a	7:17a	7:24a	7:29a	7:35a	7:40a	7:47a	7:54a	7:59a	8:05a	8:10a	8:17a	8:24a	8:29a	8:35a	8:40a	8:47a	8:54a	9:00a	9:05a	9:10a	9:17a	9:24a	9:29a	9:35a	9:40a	9:47a	9:54a	9:59a				
Transbay			7:10a		7:22a			7:40a		7:52a			8:10a		8:22a			8:40a		8:52a			9:10a		9:22a			9:40a		9:52a						

Southbound

Transbay					6:01a		6:13a		6:31a		6:43a		7:01a		7:13a		7:31a		7:43a		8:01a		8:13a		8:31a		8:43a					
4th & King	4:55a	5:25a	6:00a	6:06a	6:12a	6:18a	6:24a	6:30a	6:36a	6:42a	6:48a	6:54a	7:00a	7:06a	7:12a	7:18a	7:24a	7:30a	7:36a	7:42a	7:48a	7:54a	8:00a	8:06a	8:12a	8:18a	8:24a	8:30a	8:36a	8:42a	8:48a	8:54a
22nd Street	5:00a	5:30a	6:05a		6:17a	6:23a	6:29a	6:35a		6:47a	6:53a	6:59a	7:05a		7:17a	7:23a	7:29a	7:35a		7:47a	7:53a	7:59a	8:05a		8:17a	8:23a	8:29a	8:35a		8:47a	8:53a	8:59a
Bayshore	5:04a	5:34a	6:09a					6:39a					7:09a					7:39a					8:09a					8:39a				
South SF	5:09a	5:39a		6:17a	6:25a				6:47a	6:55a				7:17a	7:25a				7:47a	7:55a				8:17a	8:25a			8:47a	8:55a			
San Bruno	5:13a	5:43a		6:21a		6:33a			6:51a		7:03a			7:21a		7:33a			7:51a		8:03a			8:21a		8:33a		8:51a		9:03a		
Millbrae	5:16a	5:46a	6:18a	6:24a	6:31a		6:41a	6:48a	6:54a	7:01a		7:11a	7:18a	7:24a	7:31a		7:41a	7:48a	7:54a	8:01a		8:11a	8:18a	8:24a	8:31a		8:41a	8:48a	8:54a	9:01a		9:11a
Broadway	5:19a	5:49a					6:44a					7:14a					7:44a				8:14a						8:44a				9:14a	
Burlingame	5:21a	5:51a		6:28a		6:38a		6:58a		7:08a				7:28a		7:38a		7:58a		8:08a				8:28a		8:38a		8:58a		9:08a		
San Mateo	5:24a	5:54a	6:23a	6:31a		6:41a	6:48a	6:53a	7:01a		7:11a	7:18a	7:23a	7:31a		7:41a	7:48a	7:53a	8:01a		8:11a	8:18a	8:23a	8:31a		8:41a	8:48a	8:53a	9:01a		9:11a	9:18a
Hayward Park	5:26a				6:37a					7:07a					7:37a					8:07a					8:37a				9:07a			
Hillsdale	5:29a	5:59a	6:27a	6:35a		6:45a	6:52a	6:57a	7:05a		7:15a	7:22a	7:27a	7:35a		7:45a	7:52a	7:57a	8:05a		8:15a	8:22a	8:27a	8:35a		8:45a	8:52a	8:57a	9:05a		9:15a	9:22a
Belmont	5:31a	6:01a			6:41a	6:47a				7:11a	7:17a				7:41a	7:47a				8:11a	8:17a				8:41a	8:47a			9:11a	9:17a		
San Carlos	5:33a	6:03a	6:30a		6:43a		6:55a	7:00a		7:13a		7:25a	7:30a		7:43a		7:55a	8:00a		8:13a		8:25a	8:30a		8:43a		8:55a	9:00a		9:13a		9:25a
Redwood City	5:39a	6:09a	6:36a	6:42a	6:49a	6:54a	7:01a	7:06a	7:12a	7:19a	7:24a	7:31a	7:36a	7:42a	7:49a	7:54a	8:01a	8:06a	8:12a	8:19a	8:24a	8:31a	8:36a	8:42a	8:49a	8:54a	9:01a	9:06a	9:12a	9:19a	9:24a	9:31a
Atherton	5:42a	6:12a	6:39a					7:09a					7:39a				8:09a						8:39a					9:09a				
Menlo Park	5:44a	6:14a		6:46a	6:53a	6:58a	7:05a		7:16a	7:23a	7:28a	7:35a		7:46a	7:53a	7:58a	8:05a		8:16a	8:23a	8:28a	8:35a		8:46a	8:53a	8:58a	9:05a		9:16a	9:23a	9:28a	9:35a
Palo Alto	5:47a	6:17a	6:43a	6:49a	6:56a	7:02a	7:08a	7:13a	7:19a	7:26a	7:32a	7:38a	7:43a	7:49a	7:56a	8:02a	8:08a	8:13a	8:19a	8:26a	8:32a	8:38a	8:43a	8:49a	8:56a	9:02a	9:08a	9:13a	9:19a	9:26a	9:32a	9:38a
California Ave.	5:50a	6:20a		6:52a	6:59a			7:22a	7:29a					7:52a	7:59a				8:22a	8:29a				8:52a	8:59a			9:22a	9:29a			
San Antonio	5:53a	6:23a			7:02a	7:07a				7:32a	7:37a				8:02a	8:07a				8:32a	8:37a			9:02a	9:07a			9:32a	9:37a			
Mountain View	5:57a	6:27a	6:50a	6:58a	7:06a		7:15a	7:20a	7:28a	7:36a		7:45a	7:50a	7:58a	8:06a		8:15a	8:20a	8:28a		8:36a		8:45a	8:50a	8:58a	9:06a		9:15a	9:20a	9:28a	9:36a	9:45a
Sunnyvale	6:01a	6:31a	6:54a			7:14a	7:19a	7:24a			7:44a		7:54a			8:14a	8:19a	8:24a			8:44a	8:49a	8:54a			9:14a	9:19a	9:24a		9:44a	9:49a	
Lawrence	6:04a	6:34a	6:57a	7:04a		7:17a		7:27a	7:34a		7:47a		7:57a	8:04a		8:17a		8:27a	8:34a		8:47a		8:57a	9:04a		9:17a		9:27a	9:34a		9:47a	
Santa Clara	6:09a	6:39a			7:15a		7:26a			7:45a		7:54a			8:15a		8:26a			8:45a		8:56a			9:15a		9:26a		9:45a		9:56a	
College Park	12:00a	12:00a										7:56a																				
San Jose Diridon	6:11a	6:41a	7:05a	7:12a	7:19a	7:25a	7:30a	7:35a	7:42a	7:49a	7:55a	8:00a	8:05a	8:12a	8:19a	8:25a	8:30a	8:35a	8:42a	8:49a	8:55a	9:00a	9:05a	9:12a	9:19a	9:25a	9:30a	9:35a	9:42a	9:49a	9:55a	10:00a
Tamien	12:00a	6:46a			7:17a			7:35a		7:47a		8:05a		8:17a			8:35a		8:47a		9:05a			9:17a			9:35a		9:47a		10:05a	

10 Train Per Hour Schedule - With Transbay

EMU: Limited/Locals

Northbound

Tamien		9:27a		10:27a		11:27a		12:27p		1:27p		2:27p		3:27p	3:57p		4:15p		4:27p		4:45p		4:57p		5:15p		5:27p		5:45p					
San Jose Diridon	9:00a	9:30a	10:00a	10:30a	11:00a	11:30a	12:00p	12:30p	1:00p	1:30p	2:00p	2:30p	3:00p	3:30p	4:00p	4:06p	4:12p	4:18p	4:24p	4:30p	4:36p	4:42p	4:48p	4:54p	5:00p	5:06p	5:12p	5:18p	5:24p	5:30p	5:36p	5:42p	5:48p	5:54p
College Park													3:03p																					
Santa Clara	9:05a	9:35a	10:05a	10:35a	11:05a	11:35a	12:05p	12:35p	1:05p	1:35p	2:05p	2:35p	3:06p	3:35p	4:05p		4:17p			4:35p		4:47p			5:05p	5:05p	5:17p		5:35p		5:47p			
Lawrence	9:09a	9:39a	10:09a	10:39a	11:09a	11:39a	12:09p	12:39p	1:09p	1:39p	2:09p	2:39p	3:10p	3:39p		4:14p		4:26p	4:32p		4:44p		4:56p	5:02p		5:14p		5:26p	5:32p		5:44p		5:56p	6:02p
Sunnyvale	9:12a	9:42a	10:12a	10:42a	11:12a	11:42a	12:12p	12:42p	1:12p	1:42p	2:12p	2:42p	3:13p	3:42p	4:11p	4:17p			4:35p	4:41p	4:47p			5:05p	5:11p	5:17p		5:35p	5:41p	5:47p			6:05p	
Mountain View	9:17a	9:47a	10:17a	10:47a	11:17a	11:47a	12:17p	12:47p	1:17p	1:47p	2:17p	2:47p	3:18p	3:47p	4:16p		4:26p	4:33p	4:40p	4:46p		4:56p	5:03p	5:10p	5:16p		5:26p	5:33p	5:40p	5:46p		5:56p	6:03p	6:10p
San Antonio	9:20a	9:50a	10:20a	10:50a	11:20a	11:50a	12:20p	12:50p	1:20p	1:50p	2:20p	2:50p	3:21p	3:50p		4:24p	4:29p			4:54p	4:59p					5:24p	5:29p				5:54p	5:59p		
California Avenue	9:23a	9:53a	10:23a	10:53a	11:23a	11:53a	12:23p	12:53p	1:23p	1:53p	2:23p	2:53p	3:24p	3:53p			4:32p	4:38p			5:02p	5:08p					5:32p	5:38p				6:02p	6:08p	
Palo Alto	9:27a	9:57a	10:27a	10:57a	11:27a	11:57a	12:27p	12:57p	1:27p	1:57p	2:27p	2:57p	3:28p	3:57p	4:23p	4:30p	4:36p	4:42p	4:47p	4:53p	5:00p	5:06p	5:12p	5:17p	5:23p	5:30p	5:36p	5:42p	5:47p	5:53p	6:00p	6:06p	6:12p	6:17p
Menlo Park	9:29a	9:59a	10:29a	10:59a	11:29a	11:59a	12:29p	12:59p	1:29p	1:59p	2:29p	2:59p	3:30p	3:59p	4:25p	4:32p	4:38p	4:44p		4:55p	5:02p	5:08p	5:14p		5:25p	5:32p	5:38p	5:44p		5:55p	6:02p	6:08p	6:14p	
Atherton	9:31a	10:01a	10:31a	11:01a	11:31a	12:01p	12:31p	1:01p	1:31p	2:01p	2:31p	3:01p	3:32p	4:01p					4:50p				5:20p					5:50p					6:20p	
Redwood City	9:35a	10:05a	10:35a	11:05a	11:35a	12:05p	12:35p	1:05p	1:35p	2:05p	2:35p	3:05p	3:36p	4:05p	4:30p	4:37p	4:43p	4:49p	4:54p	5:00p	5:07p	5:13p	5:19p	5:24p	5:30p	5:37p	5:43p	5:49p	5:54p	6:00p	6:07p	6:13p	6:19p	6:24p
San Carlos	9:38a	10:08a	10:38a	11:08a	11:38a	12:08p	12:38p	1:08p	1:38p	2:08p	2:38p	3:08p	3:39p	4:08p	4:33p		4:46p		4:57p	5:03p		5:16p	5:27p		5:33p		5:46p		5:57p	6:03p		6:16p	6:27p	
Belmont	9:40a	10:10a	10:40a	11:10a	11:40a	12:10p	12:40p	1:10p	1:40p	2:10p	2:40p	3:10p	3:41p	4:10p		4:41p	4:48p				5:11p	5:18p				5:41p	5:48p				6:11p	6:18p		
Hillsdale	9:43a	10:13a	10:43a	11:13a	11:43a	12:13p	12:43p	1:13p	1:43p	2:13p	2:43p	3:13p	3:44p	4:13p	4:37p	4:44p		4:54p	5:01p	5:07p	5:14p		5:24p	5:31p	5:37p	5:44p		5:54p	6:01p	6:07p	6:14p		6:24p	6:31p
Hayward Park	9:45a	10:15a	10:45a	11:15a	11:45a	12:15p	12:45p	1:15p	1:45p	2:15p	2:45p	3:15p	3:46p	4:15p			4:52p				5:22p						5:52p					6:22p		
San Mateo	9:47a	10:17a	10:47a	11:17a	11:47a	12:17p	12:47p	1:17p	1:47p	2:17p	2:47p	3:17p	3:48p	4:17p	4:40p	4:47p		4:57p	5:04p	5:10p	5:17p		5:27p	5:34p	5:40p	5:47p		5:57p	6:04p	6:10p	6:17p		6:27p	6:34p
Burlingame	9:50a	10:20a	10:50a	11:20a	11:50a	12:20p	12:50p	1:20p	1:50p	2:20p	2:50p	3:20p	3:51p	4:20p		4:50p		5:00p		5:20p		5:30p				5:50p					6:20p		6:30p	
Broadway	9:52a	10:22a	10:52a	11:22a	11:52a	12:22p	12:52p	1:22p	1:52p	2:22p	2:52p	3:22p	3:53p	4:22p	4:44p				5:14p						5:44p					6:14p				
Millbrae	9:56a	10:26a	10:56a	11:26a	11:56a	12:26p	12:56p	1:26p	1:56p	2:26p	2:56p	3:26p	3:57p	4:26p	4:48p		4:59p	5:05p	5:10p	5:18p		5:29p	5:35p	5:40p	5:48p		5:59p	6:05p	6:10p	6:18p		6:29p	6:35p	6:40p
San Bruno	10:00a	10:30a	11:00a	11:30a	12:00p	12:30p	1:00p	1:30p	2:00p	2:30p	3:00p	3:30p	4:01p	4:30p		4:57p		5:09p		5:27p		5:39p				5:57p		6:09p			6:27p		6:39p	
So. San Francisco	10:04a	10:34a	11:04a	11:34a	12:04p	12:34p	1:04p	1:34p	2:04p	2:34p	3:04p	3:34p	4:05p	4:34p			5:06p	5:13p			5:36p	5:43p					6:06p	6:13p				6:36p	6:43p	
Bayshore	10:09a	10:39a	11:09a	11:39a	12:09p	12:39p	1:09p	1:39p	2:09p	2:39p	3:09p	3:39p	4:10p	4:39p					5:20p				5:50p					6:20p					6:50p	
22nd Street	10:14a	10:44a	11:14a	11:44a	12:14p	12:44p	1:14p	1:44p	2:14p	2:44p	3:14p	3:44p	4:15p	4:44p	5:02p	5:08p	5:15p		5:25p	5:32p	5:38p	5:45p	5:55p		6:02p	6:08p	6:15p		6:25p	6:32p	6:38p	6:45p	6:55p	
4th & King	10:18a	10:48a	11:18a	11:48a	12:18p	12:48p	1:18p	1:48p	2:18p	2:48p	3:18p	3:48p	4:19p	4:48p	5:06p	5:12p	5:19p	5:24p	5:29p	5:36p	5:42p	5:49p	5:54p	5:59p	6:06p	6:12p	6:19p	6:24p	6:29p	6:36p	6:42p	6:49p	6:54p	6:59p
Transbay															5:11p		5:24p			5:41p		5:54p			6:11p		6:24p		6:41p		6:54p			

Southbound

Transbay																4:01p		4:13p		4:31p		4:43p		5:01p		5:13p		5:31p		5:43p				
4th & King	9:00a	9:30a	10:00a	10:30a	11:00a	11:30a	12:00p	12:30p	1:00p	1:30p	2:00p	2:30p	3:00p	3:30p	4:00p	4:06p	4:12p	4:18p	4:24p	4:30p	4:36p	4:42p	4:48p	4:54p	5:00p	5:06p	5:12p	5:18p	5:24p	5:30p	5:36p	5:42p	5:48p	5:54p
22nd Street	9:05a	9:35a	10:05a	10:35a	11:05a	11:35a	12:05p	12:35p	1:05p	1:35p	2:05p	2:35p	3:05p	3:35p			4:17p	4:23p				4:47p	4:53p			5:17p	5:23p				5:47p	5:53p		
Bayshore	9:09a	9:39a	10:09a	10:39a	11:09a	11:39a	12:09p	12:39p	1:09p	1:39p	2:09p	2:39p	3:09p	3:39p		4:14p	4:21p			4:44p	4:51p					5:14p	5:21p				5:44p	5:51p		
South SF	9:14a	9:44a	10:14a	10:44a	11:14a	11:44a	12:14p	12:44p	1:14p	1:44p	2:14p	2:44p	3:14p	3:44p	4:11p	4:19p			4:35p	4:41p	4:49p		5:05p		5:11p	5:19p		5:35p	5:41p	5:49p			6:05p	
San Bruno	9:18a	9:48a	10:18a	10:48a	11:18a	11:48a	12:18p	12:48p	1:18p	1:48p	2:18p	2:48p	3:18p	3:48p	4:15p			4:33p		4:45p		5:03p		5:15p		5:33p		5:45p				6:03p		
Millbrae	9:21a	9:51a	10:21a	10:51a	11:21a	11:51a	12:21p	12:51p	1:21p	1:51p	2:21p	2:51p	3:21p	3:51p	4:18p	4:25p	4:30p	4:36p	4:41p	4:48p	4:55p	5:00p	5:06p	5:11p	5:18p	5:25p	5:30p	5:36p	5:41p	5:48p	5:55p	6:00p	6:06p	6:11p
Broadway	9:24a	9:54a	10:24a	10:54a	11:24a	11:54a	12:24p	12:54p	1:24p	1:54p	2:24p	2:54p	3:24p	3:54p					4:44p				5:14p					5:44p				6:14p		
Burlingame	9:26a	9:56a	10:26a	10:56a	11:26a	11:56a	12:26p	12:56p	1:26p	1:56p	2:26p	2:56p	3:26p	3:56p			4:35p	4:46p			5:05p		5:16p				5:35p		5:46p		6:05p	6:16p		
San Mateo	9:29a	9:59a	10:29a	10:59a	11:29a	11:59a	12:29p	12:59p	1:29p	1:59p	2:29p	2:59p	3:29p	3:59p	4:23p	4:30p		4:41p		4:53p	5:00p		5:11p		5:23p	5:30p		5:41p		5:53p	6:00p		6:11p	
Hayward Park	9:31a	10:01a	10:31a	11:01a	11:31a	12:01p	12:31p	1:01p	1:31p	2:01p	2:31p	3:01p	3:31p	4:01p		4:32p				5:02p						5:32p				6:02p				
Hillsdale	9:34a	10:04a	10:34a	11:04a	11:34a	12:04p	12:34p	1:04p	1:34p	2:04p	2:34p	3:04p	3:34p	4:04p	4:27p	4:35p	4:40p	4:45p	4:51p	4:57p	5:05p	5:10p	5:15p	5:21p	5:27p	5:35p	5:40p	5:45p	5:51p	5:57p	6:05p	6:10p	6:15p	6:21p
Belmont	9:36a	10:06a	10:36a	11:06a	11:36a	12:06p	12:36p	1:06p	1:36p	2:06p	2:36p	3:06p	3:36p	4:06p				4:42p	4:47p			5:12p	5:17p				5:42p	5:47p			6:12p	6:17p		
San Carlos	9:38a	10:08a	10:38a	11:08a	11:38a	12:08p	12:38p	1:08p	1:38p	2:08p	2:38p	3:08p	3:38p	4:08p	4:30p		4:44p		4:54p	5:00p		5:14p		5:24p	5:30p		5:44p		5:54p	6:00p		6:14p	6:24p	
Redwood City	9:44a	10:14a	10:44a	11:14a	11:44a	12:14p	12:44p	1:14p	1:44p	2:14p	2:44p	3:14p	3:44p	4:14p	4:36p	4:42p	4:50p		5:00p	5:06p	5:12p	5:20p		5:30p	5:36p	5:42p	5:50p		6:00p	6:06p	6:12p	6:20p	6:30p	
Atherton	9:47a	10:17a	10:47a	11:17a	11:47a	12:17p	12:47p	1:17p	1:47p	2:17p	2:47p	3:17p	3:47p	4:17p				5:03p					5:33p				6:03p					6:33p		
Menlo Park	9:49a	10:19a	10:49a	11:19a	11:49a	12:19p	12:49p	1:19p	1:49p	2:19p	2:49p	3:19p	3:49p	4:19p	4:40p	4:46p		4:57p		5:10p	5:16p		5:27p		5:40p	5:46p		5:57p		6:10p	6:16p		6:27p	
Palo Alto	9:52a	10:22a	10:52a	11:22a	11:52a	12:22p	12:52p	1:22p	1:52p	2:22p	2:52p	3:22p	3:52p	4:22p	4:43p	4:49p	4:55p	5:00p	5:07p	5:13p	5:19p	5:25p	5:30p	5:37p	5:43p	5:49p	5:55p	6:00p	6:07p	6:13p	6:19p	6:25p	6:30p	6:37p
California Ave.	9:55a	10:25a	10:55a	11:25a	11:55a	12:25p	12:55p	1:25p	1:55p	2:25p	2:55p	3:25p	3:55p	4:25p			4:58p	5:03p			5:28p	5:33p					5:58p	6:03p			6:28p	6:33p		
San Antonio	9:58a	10:28a	10:58a	11:28a	11:58a	12:28p	12:58p	1:28p	1:58p	2:28p	2:58p	3:28p	3:58p	4:28p			5:01p	5:06p			5:31p	5:36p					6:01p	6:06p			6:31p	6:36p		
Mountain View	10:02a	10:32a	11:02a	11:32a	12:02p	12:32p	1:02p	1:32p	2:02p	2:32p	3:02p	3:32p	4:02p	4:32p	4:50p	4:56p	5:05p		5:14p	5:20p	5:26p	5:35p		5:44p	5:50p	5:56p	6:05p		6:14p	6:20p	6:26p	6:35p	6:44p	
Sunnyvale	10:06a	10:36a	11:06a	11:36a	12:06p	12:36p	1:06p	1:36p	2:06p	2:36p	3:06p	3:36p	4:06p	4:36p		5:00p		5:13p	5:18p		5:30p		5:43p	5:48p		6:00p		6:13p	6:18p		6:30p	6:43p	6:48p	
Lawrence	10:09a	10:39a	11:09a	11:39a	12:09p	12:39p	1:09p	1:39p	2:09p	2:39p	3:09p	3:39p	4:09p	4:39p	4:56p	5:03p		5:16p		5:26p	5:33p		5:46p		5:56p	6:03p		6:16p		6:26p	6:33p		6:46p	
Santa Clara	10:14a	10:44a	11:14a	11:44a	12:14p	12:44p	1:14p	1:44p	2:14p	2:44p	3:14p	3:44p	4:14p	4:44p	5:01p		5:14p		5:25p	5:31p		5:44p		5:55p	6:01p		6:14p		6:25p	6:31p		6:44p	6:55p	
College Park											4:16p																							
San Jose Diridon	10:18a	10:48a	11:18a	11:48a	12:18p	12:48p	1:18p	1:48p	2:18p	2:48p	3:18p	3:48p	4:20p	4:48p	5:05p	5:11p	5:18p	5:24p	5:29p	5:35p	5:41p	5:48p	5:54p	5:59p	6:05p	6:11p	6:18p	6:24p	6:29p	6:35p	6:41p	6:48p	6:54p	6:59p
Tamien		10:53a		11:53a		12:53p		1:53p		2:53p		3:53p		4:54p		5:16p			5:34p		5:46p		6:04p			6:16p		6:34p					7:04p	

10 Train Per Hour Schedule - With Transbay

EMU: Limited/Locals

Northbound

Tamien	5:57p			6:15p		6:27p		6:45p				8:27p	9:27p		
San Jose Diridon	6:00p	6:06p	6:12p	6:18p	6:24p	6:30p	6:36p	6:42p	6:48p	6:54p	7:00p	7:30p	8:30p	9:30p	10:30p
College Park															
Santa Clara	6:05p		6:17p			6:35p		6:47p			7:05p	7:35p	8:35p	9:35p	10:35p
Lawrence		6:14p		6:26p	6:32p		6:44p		6:56p	7:02p	7:09p	7:39p	8:39p	9:39p	10:39p
Sunnyvale	6:11p	6:17p			6:35p	6:41p	6:47p			7:05p	7:12p	7:42p	8:42p	9:42p	10:42p
Mountain View	6:16p		6:26p	6:33p	6:40p	6:46p		6:56p	7:03p	7:10p	7:17p	7:47p	8:47p	9:47p	10:47p
San Antonio		6:24p	6:29p				6:54p	6:59p			7:20p	7:50p	8:50p	9:50p	10:50p
California Avenue			6:32p	6:38p				7:02p	7:08p		7:23p	7:53p	8:53p	9:53p	10:53p
Palo Alto	6:23p	6:30p	6:36p	6:42p	6:47p	6:53p	7:00p	7:06p	7:12p	7:17p	7:27p	7:57p	8:57p	9:57p	10:57p
Menlo Park	6:25p	6:32p	6:38p	6:44p		6:55p	7:02p	7:08p	7:14p		7:29p	7:59p	8:59p	9:59p	10:59p
Atherton					6:50p					7:20p	7:31p	8:01p	9:01p	10:01p	11:01p
Redwood City	6:30p	6:37p	6:43p	6:49p	6:54p	7:00p	7:07p	7:13p	7:19p	7:24p	7:35p	8:05p	9:05p	10:05p	11:05p
San Carlos	6:33p		6:46p		6:57p	7:03p		7:16p		7:27p	7:38p	8:08p	9:08p	10:08p	11:08p
Belmont		6:41p	6:48p				7:11p	7:18p			7:40p	8:10p	9:10p	10:10p	11:10p
Hillsdale	6:37p	6:44p		6:54p	7:01p	7:07p	7:14p		7:24p	7:31p	7:43p	8:13p	9:13p	10:13p	11:13p
Hayward Park			6:52p					7:22p			7:45p	8:15p	9:15p	10:15p	11:15p
San Mateo	6:40p	6:47p		6:57p	7:04p	7:10p	7:17p		7:27p	7:34p	7:47p	8:17p	9:17p	10:17p	11:17p
Burlingame		6:50p		7:00p			7:20p		7:30p		7:50p	8:20p	9:20p	10:20p	11:20p
Broadway	6:44p					7:14p					7:52p	8:22p	9:22p	10:22p	11:22p
Millbrae	6:48p		6:59p	7:05p	7:10p	7:18p		7:29p	7:35p	7:40p	7:56p	8:26p	9:26p	10:26p	11:26p
San Bruno		6:57p		7:09p			7:27p		7:39p		8:00p	8:30p	9:30p	10:30p	11:30p
So. San Francisco			7:06p	7:13p				7:36p	7:43p		8:04p	8:34p	9:34p	10:34p	11:34p
Bayshore					7:20p					7:50p	8:09p	8:39p	9:39p	10:39p	11:39p
22nd Street	7:02p	7:08p	7:15p		7:25p	7:32p	7:38p	7:45p		7:55p	8:14p	8:44p	9:44p	10:44p	11:44p
4th & King	7:06p	7:12p	7:19p	7:24p	7:29p	7:36p	7:42p	7:49p	7:54p	7:59p	8:18p	8:48p	9:48p	10:48p	11:48p
Transbay	7:11p		7:24p			7:41p		7:54p							

81

Southbound

Transbay			5:01p		5:13p		5:31p		5:43p						
4th & King	5:00p	5:06p	5:12p	5:18p	5:24p	5:30p	5:36p	5:42p	5:48p	5:54p	7:30p	8:30p	9:30p	10:30p	12:01a
22nd Street			5:17p	5:23p				5:47p	5:53p		7:35p	8:35p	9:35p	10:35p	12:06a
Bayshore		5:14p	5:21p				5:44p	5:51p			7:39p	8:39p	9:39p	10:39p	12:10a
South SF	5:11p	5:19p			5:35p	5:41p	5:49p			6:05p	7:44p	8:44p	9:44p	10:44p	12:15a
San Bruno	5:15p			5:33p		5:45p			6:03p		7:48p	8:48p	9:48p	10:48p	12:19a
Millbrae	5:18p	5:25p	5:30p	5:36p	5:41p	5:48p	5:55p	6:00p	6:06p	6:11p	7:51p	8:51p	9:51p	10:51p	12:22a
Broadway					5:44p					6:14p	7:54p	8:54p	9:54p	10:54p	12:25a
Burlingame			5:35p		5:46p			6:05p		6:16p	7:56p	8:56p	9:56p	10:56p	12:27a
San Mateo	5:23p	5:30p		5:41p		5:53p	6:00p		6:11p		7:59p	8:59p	9:59p	10:59p	12:30a
Hayward Park		5:32p					6:02p				8:01p	9:01p	10:01p	11:01p	12:32a
Hillsdale	5:27p	5:35p	5:40p	5:45p	5:51p	5:57p	6:05p	6:10p	6:15p	6:21p	8:04p	9:04p	10:04p	11:04p	12:35a
Belmont			5:42p	5:47p				6:12p	6:17p		8:06p	9:06p	10:06p	11:06p	12:37a
San Carlos	5:30p		5:44p		5:54p	6:00p		6:14p		6:24p	8:08p	9:08p	10:08p	11:08p	12:39a
Redwood City	5:36p	5:42p	5:50p			6:00p	6:06p	6:12p	6:20p	6:30p	8:14p	9:14p	10:14p	11:14p	12:45a
Atherton				6:03p						6:33p	8:17p	9:17p	10:17p	11:17p	12:48a
Menlo Park	5:40p	5:46p		5:57p		6:10p	6:16p		6:27p		8:19p	9:19p	10:19p	11:19p	12:50a
Palo Alto	5:43p	5:49p	5:55p	6:00p	6:07p	6:13p	6:19p	6:25p	6:30p	6:37p	8:22p	9:22p	10:22p	11:22p	12:53a
California Ave.			5:58p	6:03p				6:28p	6:33p		8:25p	9:25p	10:25p	11:25p	12:56a
San Antonio			6:01p	6:06p				6:31p	6:36p		8:28p	9:28p	10:28p	11:28p	12:59a
Mountain View	5:50p	5:56p	6:05p		6:14p	6:20p	6:26p	6:35p		6:44p	8:32p	9:32p	10:32p	11:32p	1:03a
Sunnyvale		6:00p		6:13p	6:18p		6:30p		6:43p	6:48p	8:36p	9:36p	10:36p	11:36p	1:07a
Lawrence	5:56p	6:03p		6:16p		6:26p	6:33p		6:46p		8:39p	9:39p	10:39p	11:39p	1:10a
Santa Clara	6:01p		6:14p		6:25p	6:31p		6:44p		6:55p	8:44p	9:44p	10:44p	11:44p	1:15a
College Park															
San Jose Diridon	6:05p	6:11p	6:18p	6:24p	6:29p	6:35p	6:41p	6:48p	6:54p	6:59p	8:46p	9:46p	10:46p	11:46p	1:17a
Tamien		6:16p			6:34p		6:46p		7:04p			9:51p	10:51p		

California High Speed Train Project



TECHNICAL MEMORANDUM

CONCEPT LEVEL OPERATIONS ANALYSIS FOR SAN FRANCISCO TERMINALS

Prepared by: James Campbell Date

Checked & Edited by: _____ Date _____
Joseph Metzler / Viktoriya Yanitskaya

Approved by: Paul Mosier Date

Released by: _____ Date _____

Revision	Date	Description

TABLE OF CONTENTS

1.0	EXECUTIVE SUMMARY	1
2.0	INTRODUCTION	4
3.0	OBJECTIVE	4
4.0	SIMULATION MODEL	5
5.0	ASSUMPTIONS	5
5.1	TRAIN PERFORMANCE CHARACTERISTICS	5
5.2	OPERATIONAL REQUIREMENTS	5
5.3	SERVICE DESIGN ASSUMPTIONS	6
5.4	INFRASTRUCTURE / MAINLINE TRACK CONFIGURATION	6
6.0	SIMULATION MODEL CASES – OPERATIONAL ANALYSIS	6
6.1	MODEL CASE 1 – ALTERNATIVE 1	8
6.2	MODEL CASE 2 – ALTERNATIVE 2	10
6.3	MODEL CASE 3 – ALTERNATIVE 3	11
6.4	MODEL CASE 4 – ALTERNATIVE 6	12
7.0	CONCLUSIONS	13

APPENDIX A: NETWORK SCHEMATICS

APPENDIX B: NETWORK STRINGLINES

APPENDIX C: TERMINAL TRACK OCCUPANCY CHARTS

CONCEPT LEVEL OPERATIONS ANALYSIS FOR SAN FRANCISCO TERMINALS

1.0 EXECUTIVE SUMMARY

A concept level analysis was undertaken to describe whether the capacity of six alternative Downtown San Francisco Terminal configurations could feasibly support the draft conceptual 2035 service levels for both the California High Speed Train Project (HST) and Caltrain (2025). This study examined the operational feasibility of six different downtown terminal track configurations and operating scenarios using future service forecasts depicting both HST and Caltrain passenger train volumes. These scenarios focused on the Downtown San Francisco Terminal and the alternatives are described as follows:

1. **Transbay Transit Center (HST Only)** - A total of six platform tracks for the HST at the Transbay Transit Center. Three approach interlocking “throat” tracks to provide universal access to all station platform tracks. Caltrain operations assumed to originate and terminate at Fourth and King Terminal and therefore were not part of the analysis of this alternative.
2. **Fourth and King Street (HST Only)** - A total of eight platform tracks for the HST at the Fourth and King Terminal. Four approach interlocking “throat” tracks to provide universal access to all station platform tracks. Caltrain operations assumed to originate and terminate at the TTC and therefore were not part of the analysis of this alternative.
3. **Transbay Transit Center and Fourth and King Street** - A “shared use” (HST and Caltrain) joint terminal option including both the Transbay Transit Center (TTC) and the Fourth and King Terminal providing a total of eight platform tracks for the HST (4 at the TTC and 4 at Fourth and King) and a total of seven platform tracks for Caltrain (2 at the TTC and 5 at Fourth and King).
4. **Fourth and King Street (Stacked Station)** - A “shared use” terminal option located at Fourth and King Street assuming an additional “level” of tracks and platforms to increase terminal capacity if sufficient capacity to accommodate the HST service plan could not be accomplished with the preceding options. The results of the Alternative 3 analysis indicated that the capacity provided (in Alternative 3) could feasibly support the HST service assumptions. Consequently, this option was removed from further consideration
5. **Beale Street (All HST service and Caltrain)**- A joint terminal option (for Caltrain) between Beale Street and Fourth and King Street providing a total of 8 platform tracks for the HST and 2 platform tracks for Caltrain. In this option there was no change to the Terminal at Fourth and King Street since no HST were assigned there.
6. **Beale Street and Fourth and King Street**- A joint terminal option between a proposed Beale Street Terminal and the Fourth and King Terminal providing a total of ten platform tracks for the HST (6 at Beale Street and 4 at Fourth and King) and a total of seven platform tracks for Caltrain (2 at Beale Street and 5 at Fourth and King).

The future daily service levels assumed for the HST were initially based on the California High Speed Rail Authority (Authority) Phase 1 Service Plan. Following this step and using this (Phase 1) service plan, additional ridership forecast data was developed and a draft conceptual service plan was crafted to reflect a preliminary level of service for the full build out year of 2035. While this preliminary full build service plan is conceptual in nature, and therefore subject to refinement, it was utilized to approximate an operating timetable that identifies 10 to 12 HST per hour operating in to and out of the San Francisco Terminal during the peak periods.

Future Caltrain service, for this analysis, was based on the JPB draft conceptual 2025 Service Plan developed by Caltrain and provided to the Authority. This (Caltrain) service plan assumes a total of 10 trains per hour during the peak periods.

Each of the terminal/station track configuration concepts was modeled using the Berkeley Simulation Software Rail Traffic Controller (RTC) to estimate the feasibility of the various track alternatives to support the assumed train volumes. In summary, the results of the study and associated analysis were as follows:

- **Alternative 1** (See Figure 1) - This alternative, with a total of six platform tracks for the HST does not provide ample capacity for the forecast HST train service levels.
- **Alternative 2** (See Figure 2) - The analysis determined that the approach interlocking “throat” track configuration for Alternative 2 did not provide the throughput capacity necessary to support the forecast HST service levels. The design configuration presented a potential “single point of failure” where one switch is the single access point to five platform tracks, thus impeding efficient operations by seriously limiting parallel movements into and out of the terminal.
- **Alternative 3** (See Figure 3) - The alignment configuration developed for the Alternative 3 two terminal/station option provides for sufficient parallel train movement capability thereby minimizing conflicts between arriving and departing trains. In addition, the number of platform tracks or “edges” provided by the combination of both terminals (8 for the HST and 7 for Caltrain) is sufficient to accommodate the assumed scheduled turnaround times (including the 30 minute exception for TTC) for both the HST and Caltrain.
- **Alternative 4** - This alternative was not subject to this study process. It was developed as a “fall back” or contingency to Alternative 3 should this (Alternative 3) concept configuration prove incapable of supporting the proposed service levels of both Caltrain and the HST. The results of the Alternative 3 analysis confirmed the ability of this (Alternative 3) terminal configuration to support the proposed service levels; consequently, it was not necessary to conduct an analysis on Alternative 4.
- **Alternative 5** (See Figures 4 & 5) - This alternative was not included as part of this analysis. For the two alignment configuration options proposed for this alternative, the first Beale Street configuration was determined to be infeasible from a constructability standpoint. For the second Beale Street configuration, based on the capacity results for Alternative 2 and the inability of an interlocking design that presents a single switch access to the platforms to support the lower train service volumes applied in the Alternative 2 analysis, it was concluded that an operations review was unnecessary.
- **Alternative 6** (See Figure 6) - The alignment configuration concept developed for the Alternative 6, two terminal option provides for sufficient parallel train movements to minimize conflicts between arriving and departing trains. The number of platform tracks or “edges” provided in the combination of both terminals (10 for HST and 7 for Caltrain) is sufficient to accommodate the assumed scheduled turnaround times for the HST and Caltrain as defined in this report within acceptable parameters of the operating assumptions.

The schedules used in this analysis for both the HST and Caltrain are not yet fully developed to operate in conjunction with each other in a fully integrated “shared use”, “joint” operating plan. Merge points at the hypothetical Bayshore alignment interchange and the deadhead movements to and from the hypothetical Bayshore storage and maintenance facility and the Terminals are still under study. In addition, these concept level draft schedules do not currently include the running time differential for Caltrain trains that do not stop at Bayshore or 22nd Street on the alignment segment to the TTC or Beale Street. These issues are begin carried forward for further study and will be addressed with further refinement of the

schedules in the next steps of the operational analysis that will include the entire rail corridor between San Francisco and San Jose.

Further details associated with each concept, the analysis and results are presented in this report.

2.0 INTRODUCTION

An examination of the design configurations for the proposed downtown San Francisco Terminal alternatives for the California High Speed Train Project (HST) was performed as part of an overall alternatives analysis to describe the feasibility of the various options to provide the operational capacity required to support the forecast HST service. The terminal alternatives studied were as follows:

- Alternative 1 (Alternatives Analysis Subsection 0b) – Transbay Transit Center (TTC) using the California High Speed Rail Authority (Authority) Phase 1 Service Schedule. See Figure 1.
- Alternative 2 (Alternatives Analysis Subsection 0c) – Fourth and King Terminal using the conceptual HST Draft Full Build Service Schedule. See Figure 2.
- Alternative 3 (Alternatives Analysis Subsection 0a) – TTC and Fourth and King Terminal using the conceptual HST Draft Full Build Service Schedule and the Caltrain Draft 2025 Schedule (as provided by the JPB). See Figure 3.
- Alternative 4– Fourth and King Terminal – “Stacked” Station (If required capacity is not provided under Alternative 3).
- Alternative 5 – Beale Street using the conceptual HST Draft Full Build Service Schedule and the Caltrain Draft 2025 Schedule. See Figures 4 and 5.
- Alternative 6 (Alternatives Analysis Subsection 0d) – Beale Street and Fourth and King Terminal using the conceptual HST Draft Full Build Service Schedule and the Caltrain Draft 2025 Schedule. See Figure 6.

This report and analysis describes each of the alternative alignment configuration concepts and their ability to support the capacity requirements of the associated service assumptions for the HST. The conclusions of this analysis will be used (in conjunction with other considerations) to describe which alignment configurations present viable solutions for addressing the capacity requirements for a San Francisco Terminal(s). Service levels assumed for this analysis were initially based on those that have been previously defined in the Authority HST Phase 1 Service Plan. For service levels associated with the CHSTP 2035 full build out, a draft conceptual service plan was developed using ridership forecast data for 2035. For scenarios that include joint HST and Caltrain operations, the JPB Draft 2025 Service Plan for Caltrain was used.

The purpose of this study is to describe whether the terminal/station(s) capacity as defined in each of the alignment concept alternatives is sufficient to feasibly support the assumed HST and/or Caltrain Service Plans. Terminal capacity in this study is defined as the “network” that includes the total number of platform tracks or “edges” and station “throat” and approach “tracks” needed to feasibly operate the assumed HST and/or Caltrain Service Plans in to and out of San Francisco.

3.0 OBJECTIVE

The number of alignment configurations, locations and service combinations identified for San Francisco requires that a concept level operational review of each of the San Francisco Terminal alternatives be conducted. This analysis is intended to further the understanding of the station track requirements for the HST service under each alternative in order to identify an operationally feasible configuration. The objective of this analysis is to describe whether the terminal capacity of the proposed alignment configuration alternatives can feasibly support the demand of the proposed HST Service Plans with a peak schedule of up to 10 to 12 trains per hour (TPH) in each direction for all alternatives, and up to 10 TPH for Caltrain in those alternatives that propose joint terminal operations.

4.0 SIMULATION MODEL

The Berkeley Simulation Software Rail Traffic Controller (RTC) simulation software (the Model) was used to simulate operations for trains arriving and departing the San Francisco Terminals in each alignment configuration. The Model was selected because it accurately simulates passenger operations using the performance characteristics of specific train-set technologies and replicates the horizontal and vertical geometric attributes of the track infrastructure. It provides the range of information and analytical and reporting capabilities required for this analysis and was designed as a flexible tool that can be modified, refined and upgraded to examine a variety of operational and infrastructure alternatives. This dynamic train simulation instrument is also the Model selected as the primary tool for operations/capacity analysis and infrastructure validation for the CHSTP.

5.0 ASSUMPTIONS

There are three principal categories of assumptions that were applied universally to all scenarios simulated for the operational analyses of the San Francisco Terminal alignment alternatives:

- Train Performance Characteristics
- Operational Requirements and Service Design
- Infrastructure / Track Configuration

5.1 TRAIN PERFORMANCE CHARACTERISTICS

The train characteristics that are universally applicable to all of the simulation Model alternatives include:

- For HST: characteristics based upon the specifications for the French AGV train-sets. These train-sets are 400 meters long and capable of reaching speeds up to 220 mph.
- For Caltrain: characteristics based upon the specifications for an 8 car Siemens DD EMU capable of reaching speeds of up to 110 mph.

5.2 OPERATIONAL REQUIREMENTS

- HST service operates non-stop Millbrae to San Francisco
- HST maximum operating speed will be 125 miles per hour (mph)
- Caltrain maximum operating speed was assumed to be 110 mph, except where specific “civil” restrictions may apply
- HST and Caltrain non-revenue to revenue and revenue to non-revenue trains are assumed to have a turnaround time of 15 minutes
- Morning “start up” trains originate from a yard facility assumed to be in proximity to Bayshore
- Operations were simulated for the time period from 4:00 A.M. to 8:00 P.M.

5.3 SERVICE DESIGN ASSUMPTIONS

The service level assumptions applied in the Model are as follows:

- HST Service Plan: Train schedules as documented in this analysis are based on a conceptual draft full build service plan that was developed using the CHSTP ridership forecast data for 2035. The conceptual service plan identifies 10 to 12 trains per hour operating in to and out of the terminal during the peak periods.
- Caltrain Service Plan: Train schedules for Caltrain are based on the Draft conceptual 2025 Service Plan developed by Caltrain that assumes a total of 10 trains per hour, 4 to the TTC and 6 to Fourth and King Terminal.

The schedules used in this analysis for both the HST and Caltrain are not yet fully developed to operate in conjunction with each other in a fully integrated operating plan. They do not include the “merge points” at the hypothetical Bayshore Alignment interchange or for the deadhead movements to and from the hypothetical Bayshore storage and maintenance facility and the Terminals. In addition, these schedules do not currently include the running time differential for Caltrain trains that do not stop at Bayshore or 22nd Street when routed to the TTC or Beale Street. These issues are being carried forward for further study and will be addressed with the schedules further refined in the next steps of the operational analysis that will include the entire rail corridor between San Francisco and San Jose.

5.4 INFRASTRUCTURE / MAINLINE TRACK CONFIGURATION

The primary study area for the analysis was composed of the mainline segment of the peninsula corridor between Millbrae and downtown San Francisco. Note that north of Control Point (CP) Army; alignments are configured to conform to the specific terminal concepts developed for each alternative.

6.0 SIMULATION MODEL CASES – OPERATIONAL ANALYSIS

The Model was developed to represent the assumed service attributes and physical characteristics of the portion of the peninsula corridor between Millbrae and San Francisco, focusing on the capacity of the different terminal configuration alternatives. This section describes the terminal configuration concepts and assumptions applied to each specific simulation Model Case, and also summarizes the results of each scenario as follows:

Model Case 1 – Alternative 1: Transbay Transit Center Only (See Figure 1)

The alignment configuration assumed for the Transbay Transit Center (TTC) followed the design developed for the Locally Preferred Alternative (LPA) and presented in the Project Specific Environmental Impact Report / Environmental Impact Statement (EIR/EIS). This includes:

- Total of six platform tracks; this alternative assumes all six tracks for HST.
- Three approach interlocking “throat” tracks to provide universal access to all station platform tracks.
- Two track mainline connection provided for the Caltrain mainline at Control Point (CP) Common.
 - Universal crossovers provided at CP Common.

Model Case 2 – Alternative 2: Fourth and King Terminal Only (See Figure 2)

- Total of eight platform tracks for the HST service at Fourth and King Terminal
- Beginning at CP Common, four approach interlocking “throat” tracks to provide access to all station platform tracks
- Two track mainline for the HST from Millbrae to CP Common
- Hypothetical HST layover and storage facility at Bayshore
 - Inbound yard lead from Bayshore connects to mainline at CP Common; outbound lead connects to mainline near CP Army.

Model Case 3 – Alternative 3: TTC and Fourth and King Terminals (See Figure 3)

The conceptual alignment for Alternative 3 assumes:

- Four tracks total between Millbrae and Bayshore.
 - Two tracks predominantly for Caltrain (during peak periods)
 - Two tracks predominantly for the HST (during peak periods)
- North and South of Bayshore,
 - Grade separated crossovers at Bayshore allow for universal access between the four mainline tracks and the Bayshore maintenance facility.
- Stops are provided to Bayshore and 22nd Street stations for Caltrain only.
- Four mainline tracks between Bayshore and CP Common.
 - Two tracks for “shared use” between the HST and Caltrain to the TTC
 - Two tracks for “shared use” between the HST and Caltrain to the Fourth and King Terminal
- Two yard lead tracks are necessary from the hypothetical Bayshore maintenance facility to the mainline.
- Subterranean station at Fourth and Townsend with outside platforms for exclusive use by Caltrain
- Three platforms and six tracks in the TTC
 - Four northern tracks are for the exclusive use of the HST
 - Two southern tracks are for the exclusive use of Caltrain
 - Three approach “shared use” interlocking “throat” tracks to provide universal access to/from all station platform tracks.
- Five platforms and nine tracks total in the Fourth and King Terminal
 - Four northern tracks are for the exclusive use of the HST
 - Five southern tracks are for the exclusive use of Caltrain
 - Three approach interlocking “throat” tracks that provide universal access to all Caltrain platform tracks and HST platform track one. HST platform tracks 2, 3 and 4 are accessed from the western two “throat” tracks only.

Model Case 4 – Alternative 6: Beale Street and Fourth and King Terminals (See Figure 5)

The conceptual alignment for Alternative 6 assumes:

- Four tracks total between Millbrae and Bayshore.
 - Two tracks predominantly for Caltrain (during peak periods)
 - Two tracks predominantly for the HST (during peak periods)
- North and South of Bayshore:
 - Grade separated crossovers at Bayshore allow for universal access between the four mainline tracks and the Bayshore maintenance facility.
- Stops are provided to Bayshore and 22nd Street stations for Caltrain only.
- Four mainline tracks between Bayshore and CP Common.
 - Two tracks for “shared use” between the HST and Caltrain to the TTC
 - Two tracks for “shared use” between the HST and Caltrain to the Fourth and King Terminal
- Two yard lead tracks are necessary from the hypothetical Bayshore maintenance facility to the mainline.
- Subterranean station at Fourth and Townsend with island platform for exclusive use by Caltrain
- Four platforms and eight tracks total in the Beale Street Terminal
 - Six western tracks are for the exclusive use of the HST
 - Two eastern tracks are for the exclusive use of Caltrain
 - Three approach interlocking “throat” tracks to provide universal access to all station platform tracks.
- Five platforms and nine tracks total in Fourth and King Terminal
 - Four northern tracks are for the exclusive use of the HST
 - Five southern tracks are for the exclusive use of Caltrain
 - Three approach interlocking “throat” tracks that provide universal access to all Caltrain platform tracks and the HST platform track one. HST platform tracks 2, 3 and 4 are accessed from the western two “throat” tracks only.

6.1 MODEL CASE 1 – ALTERNATIVE 1

Assumptions

The San Francisco Terminal configuration Model Case 1 assumed:

- Service Level Assumptions: As described in Section 5.3 plus:
 - Only the HST operations were simulated using the CHSTP Phase 1 Service Plan.
 - Caltrain operations are assumed to operate to Fourth and King Terminal; no Caltrain operations were simulated in this Case.

- All revenue to revenue train turns for the HST were scheduled based on the assumption of a 30 minute turnaround time, which is an exception to the minimum scheduled CHSTP system turnaround time assumed to be 40 minutes.

Approach

The San Francisco Terminal Model Case 1 (refer to Appendix A – Figure 1) examined the capacity of the TTC in its ability to accommodate the conceptual HST Phase 1 service plan with six platform tracks and three approach interlocking “throat” tracks to provide universal access to all station platform tracks. Caltrain operations were assumed to be located at the Fourth and King station.

Objective

The purpose of the San Francisco Terminal Model Case 1 was to describe, at a conceptual level of analysis, the feasibility of the assumed terminal configuration of six platform tracks at the TTC to provide sufficient capacity to operate the forecast levels of HST service.

Conclusions

The Alternative 1 San Francisco Terminal alignment configuration as currently presented is unable to meet the needs of the HST operation as assumed in the Phase 1 Service Plan, and consequently the Full Build Service Plan (which has higher service levels). Only during the start-up period in the early morning timeframe, when trains arrive from the storage yard and require a 15 minute turnaround time, is adequate terminal capacity available. For the majority of the service day, when all of the trains are operating in revenue service and performing revenue to revenue “turns”, the terminal capacity is constrained to 4 to 5 trains per hour. This is significantly less than the 8 to 9 trains per hour presented in the Phase 1 Service Plan or the 10 to 12 trains per hour assumed in the Full Build Service Plan.

In order to respond effectively to the CHSTP ridership demand forecast, the high speed rail “inter-city” service pattern developed in the Phase 1 Service Plan required scheduling “clusters” of trains operating throughout the day rather than “even” intervals or “headways” typical of conventional, short distance transit systems (such as heavy rail transit and LRT) . This results in trains arriving and departing the TTC in groups of two or three trains with time separations ranging from two to four minutes. This service pattern creates an imbalance in the arrivals and departures (i.e. uneven arriving and intervals) within a 60 minute period. Consequently, the elapsed turnaround time for an arriving train to the next departing train (that satisfies the assumed 30 minute scheduled turnaround time) can lead to turn times that are slightly shorter or longer than the 30 minute objective. Significant “gaps” begin to occur in the capacity of the TTC using the CHSTP Phase 1 Schedule demand in the 8:00 A.M. to 9:00 A.M. period where the turn-around time dynamics begin to deteriorate below the assumed minimum of 30 minutes. This deterioration increases through-out the remainder of the morning simulation period forcing the reduction of turn-around time to unacceptably shorter durations. In order to achieve even the “exceptional” minimum turn-around time adopted for the TTC analysis there would need to be an additional number of station tracks and platform “edges” provided. The simulation showed that there is insufficient capacity during the morning peak period at the TTC indicating that this alternative is not feasible and rendered the remaining step (testing the Full Buildout service plan) of the Alternative 1 simulation unnecessary. Noting that the TTC did not provide sufficient capacity to support the Phase 1 Schedule it was determined that the Full Build Service Plan, which has more trains (than Phase 1) would similarly prove infeasible.

6.2 MODEL CASE 2 – ALTERNATIVE 2

Assumptions

The San Francisco Terminal configuration Model Case 2 assumed:

- Service Level Assumptions: As described in Section 5.3 plus:
 - Maximum of 12 HST per hour in each direction based on the conceptual draft Full Build service plan
 - Caltrain operations are assumed to operate to the TTC; no Caltrain operations were simulated in this Case.

Approach

The San Francisco Terminal Model Case 2 (refer to Appendix A – Figure 2) examined the capacity of the Fourth and King Terminal in its ability to accommodate the conceptual HST service plan with eight platform tracks (“edges”) and four approach interlocking “throat” tracks to provide universal access to and from all station platform tracks.

Objective

The purpose of the San Francisco Terminal Model Case 2 was to describe, at a conceptual level of analysis, the feasibility of the assumed terminal configuration of eight platform tracks at the Fourth and King Terminal to provide sufficient capacity to operate the forecast levels of HST.

Conclusions

The Alternative 2 San Francisco Terminal alignment configuration as currently presented will not support the operation of the conceptual CHSTP Draft Full Build Service Plan assumed in this analysis. The configuration of the interlocking at CP Common creates a single point of failure for the approach to Fourth and King Terminal, consistently causing multiple delays of between 45 seconds and 8.5 minutes to both inbound and outbound trains. This single point of failure is considered a “fatal flaw” in the Alternative 2 design.

The results of the simulation analysis conducted on the Alternative 2 alignment configuration and the conceptual HST service patterns indicated that the interlocking proposed at CP Common is not sufficient to allow the necessary train movements required to support the maximum of 12 trains per hour assumed during the maximum peak periods of service as identified in the service plan. The alignment configuration proposed for this alternative creates a “single point of failure” for the approach to the terminal located at CP Common in which parallel train movements are severely limited. In practical terms this means that access to platforms five through nine can only be provided by passing through a single switch point at CP Common. With some trains scheduled as close as 3 minutes apart during peak periods for both inbound and outbound trains, providing only a “single point” for access to five platforms does not provide the through-put capacity required to reliably maintain schedule adherence and on-time performance.

The movement of trains within the terminal is further constrained as a result of the revenue to non-revenue and non-revenue to revenue movements to and from the yard. To minimize platform occupancy times, up to 5 trains per hour during the peak are required to deadhead to/from the yard rather than remain at the terminal platform to turn. This occurs when there are more trains arriving in a 60 minute period than there are platform tracks to accommodate these arriving trains assuming a standard 40 minute turnaround time. To further help in addressing this capacity issue, exceptions were made in some cases by “scheduling” turnaround times less than 40 minutes in order to minimize the number of trains traveling to and from the yard. However turnaround times of less than 36

minutes were not assumed. Throughout the course of the simulation, 10 train sets were scheduled with 36 to 39 minute turnaround times.

6.3 MODEL CASE 3 – ALTERNATIVE 3

Assumptions

The San Francisco Terminal configuration Model Case 3 assumed:

- Service Level Assumptions: As described in Section 5.3 plus:
 - Maximum of 12 HST per hour in each direction based on a conceptual draft Full Build service plan
 - Maximum of 10 Caltrain trains per hour in each direction based on the Draft Caltrain 2025 Service Plan, 4 trains to the TTC and 6 to Fourth and King.

Approach

The San Francisco Terminal Model Case 3 (refer to Appendix A – Figure 3) examined the capacity of a joint San Francisco Terminal between the Fourth and King Station and the TTC and their combined ability to support the conceptual HST and Caltrain draft service plans with a total of eight platform tracks for the HST (4 at TTC and 4 at Fourth and King) and a total of seven platform tracks for Caltrain (2 at TTC and 5 at Fourth and King). The approach interlocking “throat” tracks to the TTC provide universal access to and from all station platform tracks. For Fourth and King Terminal, the approach interlocking “throat” tracks provide universal access to all Caltrain platform tracks and HST platform track one. HST platform tracks 2, 3 and 4 are accessed from the western two “throat” tracks only.

Objective

The purpose of the San Francisco Terminal Model Case 3 was to describe, at a conceptual level of analysis, the feasibility of the assumed terminal configuration, consisting of a total of eight platform tracks for the HST and a total of seven platform tracks for Caltrain between the TTC and the Fourth and King Terminal, to provide sufficient capacity to operate the forecast levels for HST and Caltrain trains.

Conclusions

The Alternative 3 San Francisco Terminal alignment configuration as currently presented can feasibly support the operation of the conceptual HST and Caltrain draft service plans as assumed in this analysis. The alignment configurations developed for the two terminals provide sufficient parallel train movement capability to minimize conflicts between arriving and departing trains. The number of platform “edges” provided between both terminals (8 for the CHSTP and 7 for Caltrain) is sufficient to accommodate the assumed turnaround times (including the 30” HST exception for TTC) for the HST and Caltrain as defined in this report with limited exceptions.

At Fourth and King Street Terminal, revenue to revenue train turns for the HST were scheduled based on the assumption of a 40 minute turnaround time. Due to the turnaround time exception previously assumed for the TTC, the HST turnaround times at the TTC used in the analysis were 30 minutes. Turn-around times for Caltrain were assumed to be 20 minutes for standard revenue to revenue service and 15 minutes for revenue to non-revenue trains. The interlocking “throat” in this alternative for Fourth and King allows for multiple parallel train movements in and out of the facility, which is an improvement over Alternative 2 due to the shorter Caltrain platform length requirements. This allows the interlocking to “process” a higher number of trains per hour. When compared to the observations in Alternative 2, where the “fatal flaw” was identified in the interlocking configuration at CP Common and its failure to provide parallel train movement capability causing a “single point of

failure”, the Alternative 3 CP Common interlocking configuration is more robust. This is because, with the introduction of Caltrain service, two of the 400 meter platforms designated in Alternative 2 for HST service could be shortened in length to accommodate the 8 car Caltrain consists. The platform reductions provided more “space”, allowing the interlocking configurations to be improved to thereby increasing through-put at CP Common and mitigating the “single point of failure”.

The results of the simulation analysis conducted on the Alternative 3 alignment configuration indicated that while there are some exceptions to the assumed minimum turnaround times for the HST, (5 trains have turnaround times between 27 and 29 minutes at the TTC and 7 trains have turnaround times between 34 and 39 minutes at Fourth and King) all trains for both services were able to be run in accordance with their schedules.

It should be noted here that the schedules used in this analysis for both the HST and Caltrain are conceptual and not, as yet designed to operate in conjunction with each other in a fully integrated operating plan. They do not include merge points at the hypothetical Bayshore Alignment interchange and they do not account for the running time differential for Caltrain trains that do not stop at Bayshore or 22nd Street when routed to the TTC. These issues will be addressed and the schedules further refined in the next steps of the operational analysis that will include the entire rail corridor between San Francisco and San Jose.

6.4 MODEL CASE 4 – ALTERNATIVE 6

Assumptions

The San Francisco Terminal configuration Model Case 4 assumed:

- Service Level Assumptions: As described in Section 5.3 plus:
 - Maximum of 12 HST per hour in each direction based on the conceptual draft Full Build service plan that was developed using ridership forecast data for 2035
 - Maximum of 10 Caltrain trains per hour in each direction based on the Caltrain Draft 2025 Service Plan, 4 trains to Beale Street and 6 trains to Fourth and King.

Approach

The San Francisco Terminal Model Case 4 (refer to Appendix A – Figure 6) examined the capacity of a joint San Francisco Terminal between the Fourth and King Terminal and Beale Street and their combined ability to support the conceptual HST and Caltrain draft service plans with a total of ten platform tracks for the HST (6 at Beale Street and 4 at Fourth and King) and a total of seven platform tracks for Caltrain (2 at Beale Street and 5 at Fourth and King). The approach interlocking “throat” tracks to the Beale Street Terminal provide universal access to and from all station platform tracks. For Fourth and King Terminal, the approach interlocking “throat” tracks provide universal access to all Caltrain platform tracks and HST platform track one. HST platform tracks 2, 3 and 4 are accessed from the western two “throat” tracks only.

Objective

The purpose of the San Francisco Terminal Model Case 4 was to describe, at a conceptual level of analysis, the feasibility of the assumed terminal configuration, consisting of a total of ten platform tracks for the HST and a total of seven platform tracks for Caltrain between the combined Beale Street and Fourth and King Terminals, to provide sufficient capacity to operate the assumed forecast service levels for the HST and Caltrain trains.

Conclusions

The Alternative 6 San Francisco Terminal alignment configuration as currently presented can feasibly support the operation of the conceptual HST and Caltrain service plans as assumed in this analysis. The alignment configurations developed for the two terminals provide sufficient parallel train movement capability to minimize conflicts between arriving and departing trains. The total number of platform tracks or “edges” provided in both terminals combined (10 for HST and 7 for Caltrain) is sufficient to accommodate the assumed turnaround times for the HST and Caltrain as defined in this report within acceptable parameters of the operating assumptions.

At both Fourth and King Street Terminal and Beale Street all revenue to revenue train turns for the HST were scheduled based on the assumption of a 40 minute turnaround time. The interlocking “throat” throughput for Fourth and King used the same configuration as in Alternative 3 and allows for multiple parallel train movements in to and out of the facility, which is an improvement over Alternative 2 due to the shorter Caltrain platform length requirements. This allows the interlocking to process a higher number of trains per hour. The three track “throat” to Beale Street provides an interlocking with multiple routing options allowing for parallel train movements to and from multiple platforms, increasing the overall train processing capability of the terminal compared to Alternative 3. This three track throat arrangement is successful in this alternative (as compared to a similar configuration assumed for Alternative 5) because the set of “universal” crossover switches are located closer to the terminal, thus reducing the time that trains would occupy any given arriving or departing routes.

The results of the simulation analysis conducted for the Alternative 6 alignment configuration indicated that while there are some exceptions to the assumed minimum turnaround times for both the HST and Caltrain, all trains for both services were able to be run in accordance with their schedules.

It should be noted here that the schedules used in this analysis for both the HST and Caltrain are conceptual and not, as yet designed to operate in conjunction with each other in a fully integrated operating plan. They do not include the merge points at the hypothetical Bayshore Alignment interchange and they do not account for the running time differential for Caltrain trains that do not stop at Bayshore or 22nd Street when routed to the TTC. These issues will be addressed and the schedules further refined in the next steps of the operational analysis that will include the entire rail corridor between San Francisco and San Jose.

7.0 CONCLUSIONS

Based on the analyses conducted of the four Alternatives selected for simulation modeling, it was determined that Alternatives 3 and 6 are the two alignment configurations that offer a feasible configuration for achieving the necessary capacity and assumed service and operational objectives. Alternatives 1 and 2 did not provide sufficient capacity to feasibly support the conceptual HST service level requirements of up to 12 trains per hour in each direction as assumed in the Full Build Out Draft Conceptual Service Plan.

It should be noted that Alternatives 4 and 5 were “dropped” from consideration prior to conducting the operational simulation, modeling analysis. Alternative 4 was developed exclusively as a “fall back” contingency to Alternative 3 should the alignment configuration simulated proved to be unable to support the proposed service levels of both Caltrain and the HST. With the results of the modeling and analysis confirming the ability of the terminal configuration proposed in Alternative 3 to provide sufficient capacity to support the assumed service levels, there was no longer the necessity for further study of Alternative 4.

For Alternative 5, two conceptual variations for proposed configurations were reviewed. The first option (Beale Street Alt. 5A – Figure 4) depicted a “universal access” interlocking achieved through the use of switching “ladders” that enabled both parallel train movements and multiple routing options for trains. In particular, any track in the terminal could be reached by arriving and departing trains and the “throat” of this interlocking arrangement was located at the immediate entrance of the terminal. .

The second option (Beale Street Alt. 5B – Figure 5) described the same 10 track terminal arrangement as Alt.5A, but described a completely different interlocking arrangement. In this interlocking arrangement the “throat” was designed to be much farther away from the terminal. It was also significantly smaller and provided access to the terminal via three “branch routes”. The “branch routes” provided some ability for parallel routing to 4 tracks located in the middle of the station but manifested “single point of failure” access to the 6 outside station tracks. This configuration would “force” arriving and departing trains located on the outside of the terminal to be routed in a manner that precluded other trains from moving until they were entirely clear of the interlocking throat, a throat which in this alternative, is farther away from the station. Additionally, trains would be forced to “queue” up on the approach tracks waiting for conflicting routes and/or preceding trains to clear coming into or moving out of the terminal. The results of the analysis indicated that this terminal configuration does not support the assumed HST or Caltrain train operations previously described for this alternative.

The Beale Street Alt.5A configuration as depicted was determined to be infeasible for constructability reasons. Based on the previous analysis describing the inability of “single point of failure” interlocking designs to support the lower train service volumes used in Alternative 2, it was neither prudent nor practicable to conduct an operations simulation using the configuration design proposed in Beale Street Alt. 5B.



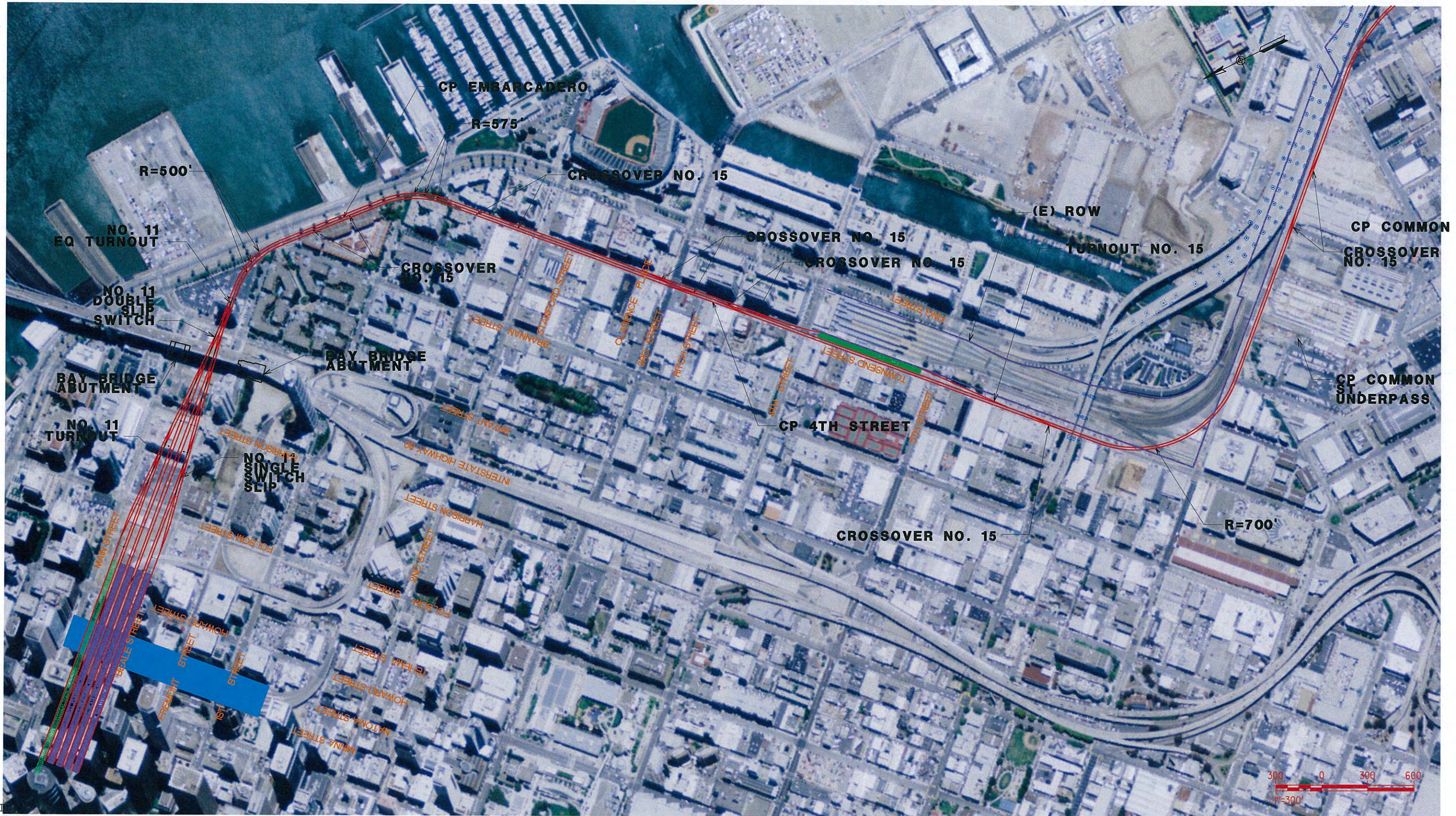
REV	DATE	BY	CHK	APP	DESCRIPTION

DESIGNED BY
DRAWN BY
CHECKED BY
IN CHARGE
DATE
03-24-10



CALIFORNIA HIGH-SPEED TRAIN PROJECT
SAN FRANCISCO
ALTERNATIVE 1: TRANSBAY
TRANSIT CENTER (HST) ONLY
AA ALTERNATIVE 0B
FIGURE 1

CONTRACT NO.	XXX
DRAWING NO.	
SCALE	1"=300'
SHEET NO.	OF



NOT
1. TURNOUTS NORTH OF 4TH AND KING ARE ON DIRECT FIXATION TRACK AND HAVE POINT OF SWITCH AT HEEL OF FROG OF PRECEDING TURNOUT.

REV	DATE	BY	CHK	APP	DESCRIPTION

DESIGNED BY
DRAWN BY
CHECKED BY
IN CHARGE
DATE 03-25-10



CALIFORNIA HIGH-SPEED TRAIN PROJECT
SAN FRANCISCO
ALTERNATIVE 5A: BEALE STREET
(ALL HST AND CALTRAIN)
AA ALTERNATIVE OD
FIGURE 4

CONTRACT NO. XXX
DRAWING NO.
SCALE 1"=300'
SHEET NO. OF



NOTES:
1. TURNOUTS NORTH OF 4TH AND KING ARE ON DIRECT FIXATION TRACK AND HAVE POINT OF SWITCH AT HEEL OF FROG OF PRECEDING TURNOUT.

						DESIGNED BY	
						DRAWN BY	
						CHECKED BY	
						IN CHARGE	
						DATE	03-25-10
REV	DATE	BY	CHK	APP	DESCRIPTION		



CALIFORNIA HIGH-SPEED TRAIN PROJECT
SAN FRANCISCO
ALTERNATIVE 5B: BEALE STREET
(ALL HST AND CALTRAIN)
AA ALTERNATIVE OD
FIGURE 5

CONTRACT NO.	XXX
DRAWING NO.	
SCALE	1"=300'
SHEET NO.	OF



REV	DATE	BY	CHK	APP	DESCRIPTION

DESIGNED BY
DRAWN BY
CHECKED BY
IN CHARGE
DATE

03-25-10



CALIFORNIA HIGH-SPEED RAIL AUTHORITY
FLY CALIFORNIA
Without ever leaving the ground.

CALIFORNIA HIGH-SPEED TRAIN PROJECT
SAN FRANCISCO
ALTERNATIVE 6: BEALE STREET
AND 4TH STREET AND KING STREET
AA ALTERNATIVE OD
FIGURE 6

CONTRACT NO.	XXX
DRAWING NO.	
SCALE	1"=300'
SHEET NO.	OF

FOR STUDY PURPOSES ONLY

PLATFORMS:
1300' LENGTH
30' WIDTH

BAY BRIDGE

SEWER OUTFALL
CONSOLIDATION
BOX STRUCTURE

SEAWALL

FUTURE EAST
BAY TUNNEL

CUT & COVER
SUBWAY

DEMOLISH
RESIDENTIAL
HIGH-RISE
BUILDING

BAY BRIDGE
ANCHORAGE

DEMOLISH
RESIDENTIAL
MID-RISE
BUILDING

DEMOLISH
US POSTAL
FACILITY

REBUILD BRIDGE OVER
BEALE STREET

FUTURE EAST
BAY TUNNEL

ALTERNATIVE 7
BEALE STREET (ALL HST AND CALTRAIN)
AA ALTERNATIVE 0D
FIGURE 7

CONCEPTUAL ENGINEERING REVIEW OF BEALE STREET
SAN FRANCISCO TERMINAL PROPOSAL

11/25/2009
PARSONS



6 Track Transbay Terminal Configuration

Transbay

4th&Townsend

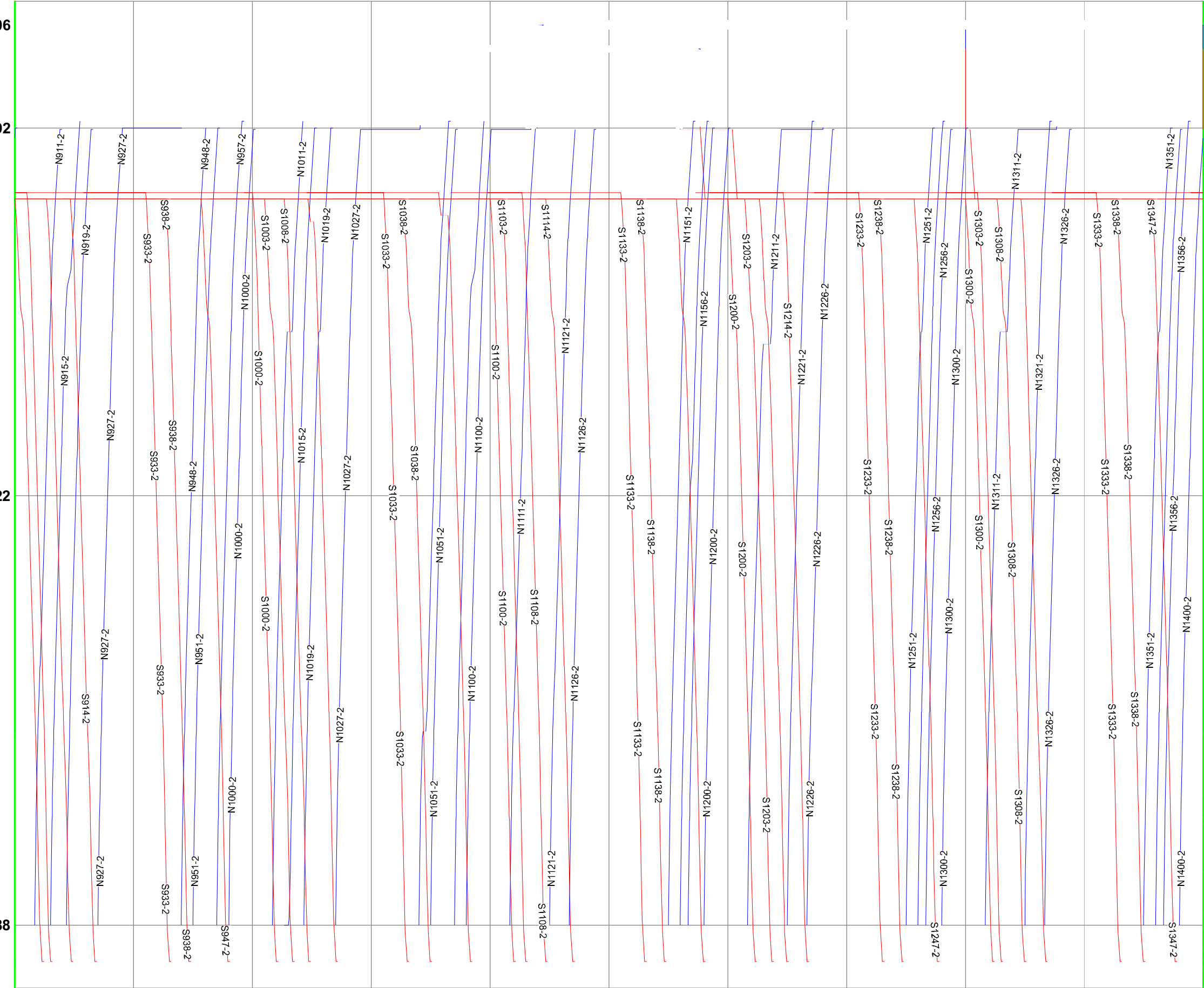
22nd StrN

2906

4792

11522

19388



9:00

9:30

10:00

10:30

11:00

11:30

12:00

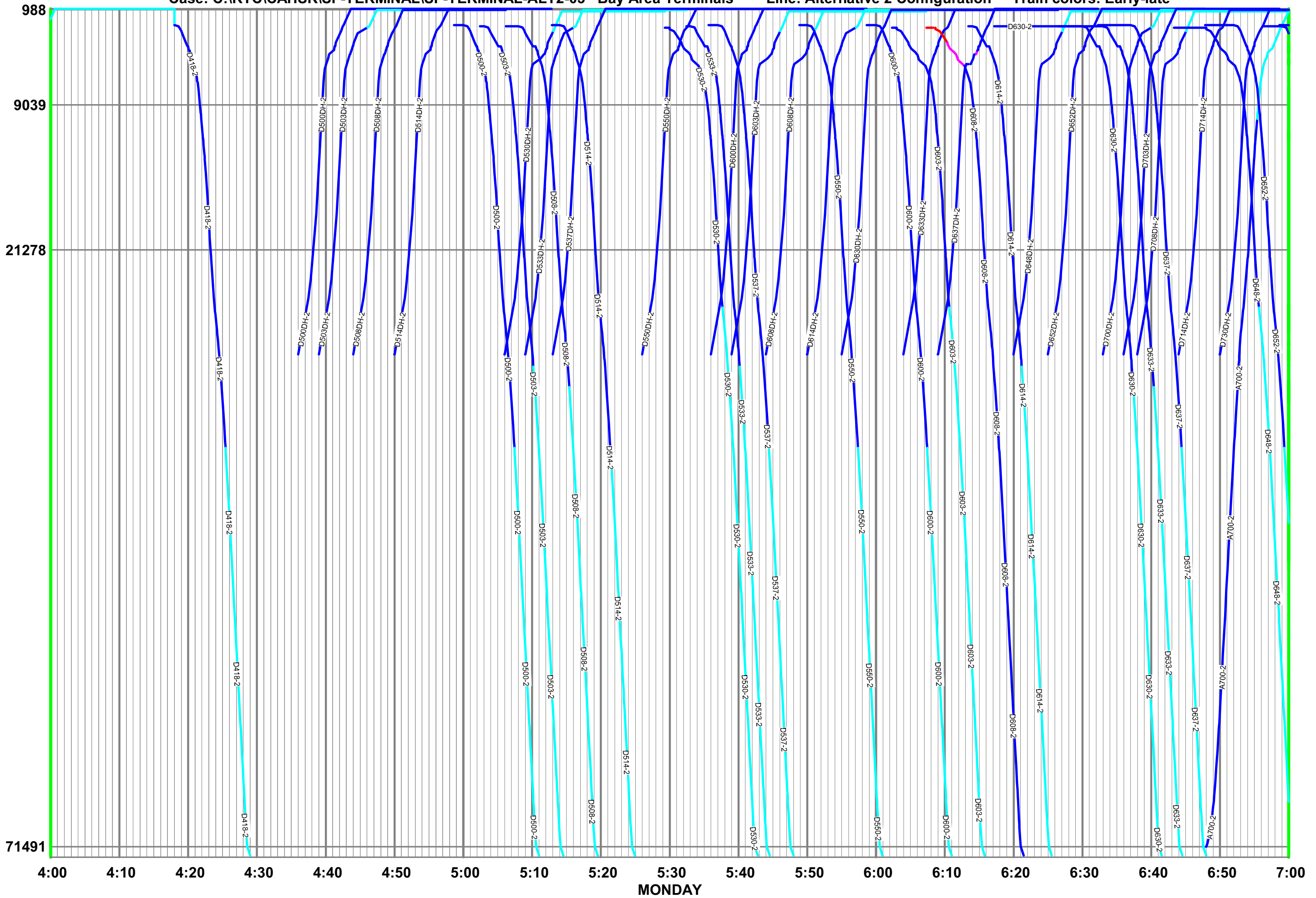
12:30

13:00

13:30

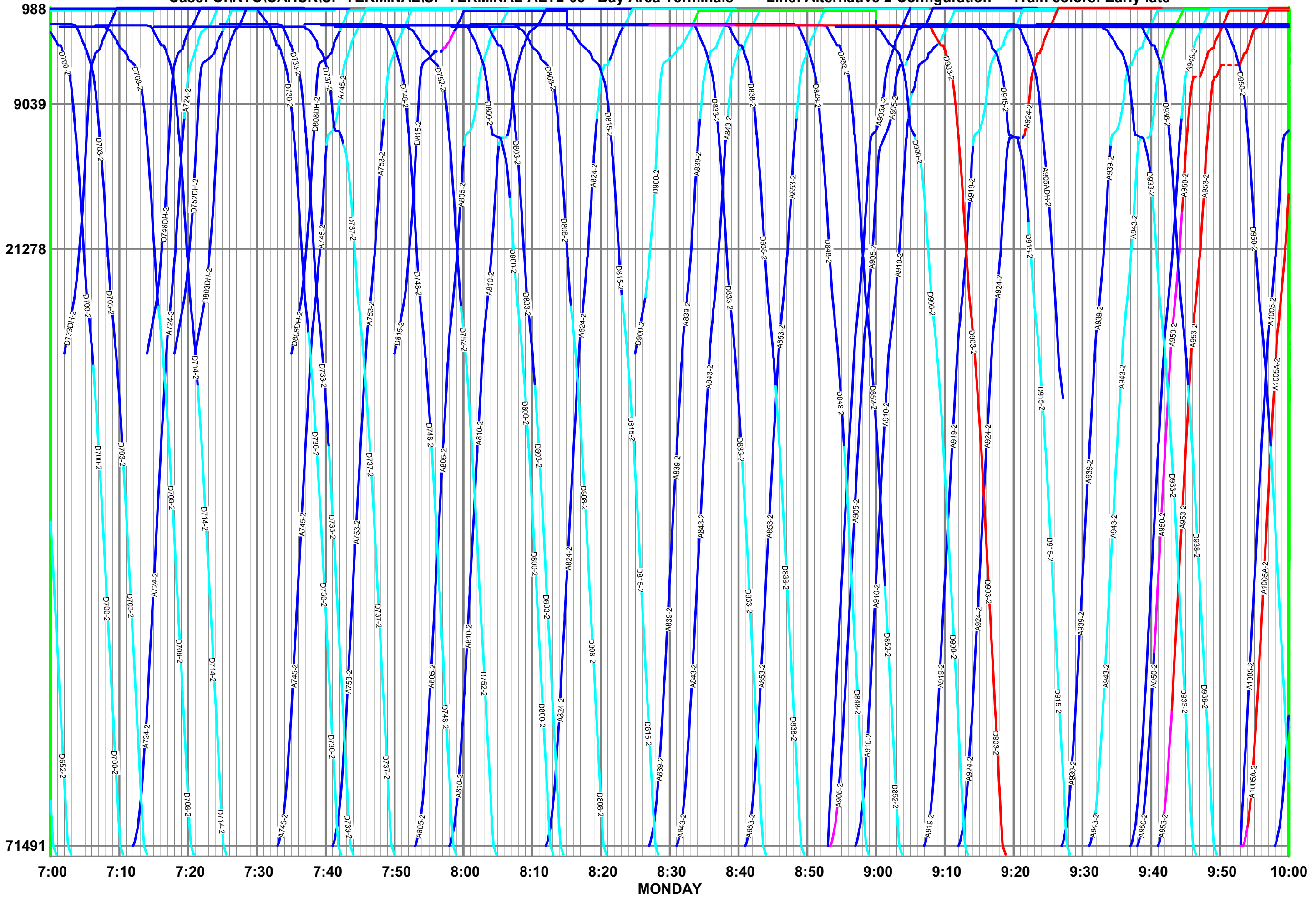
14:00

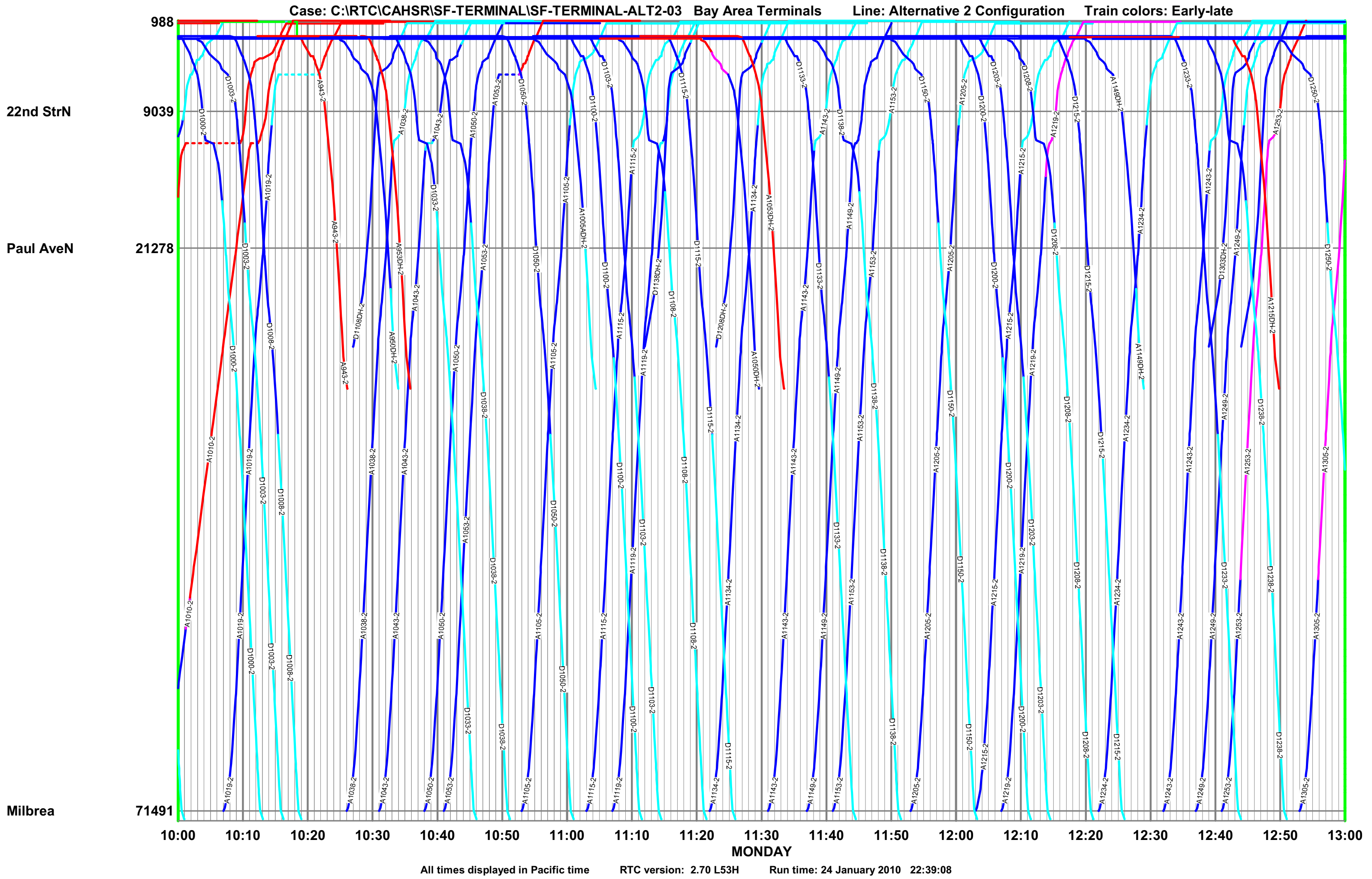
6 Track Transbay Terminal Configuration

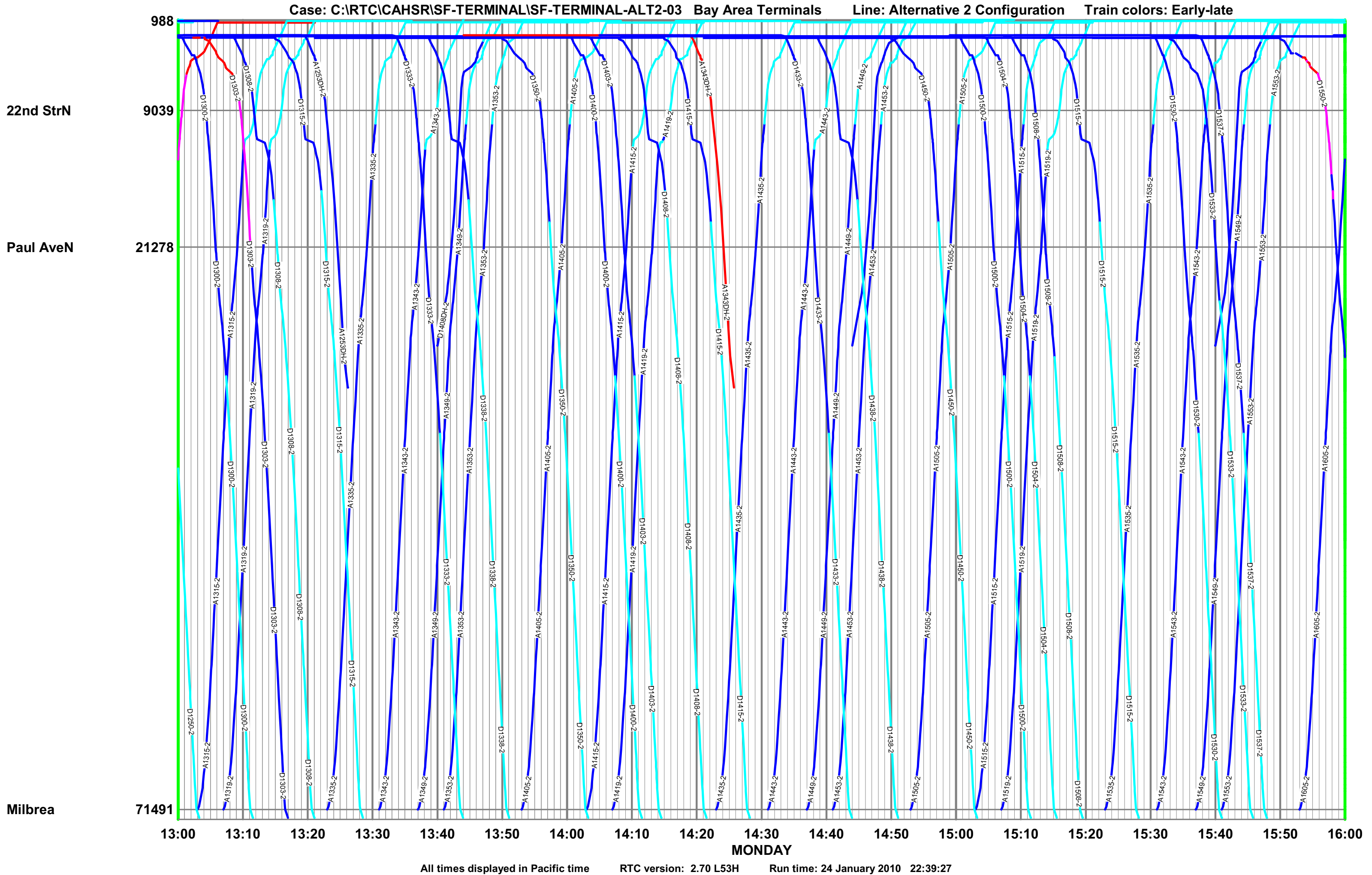


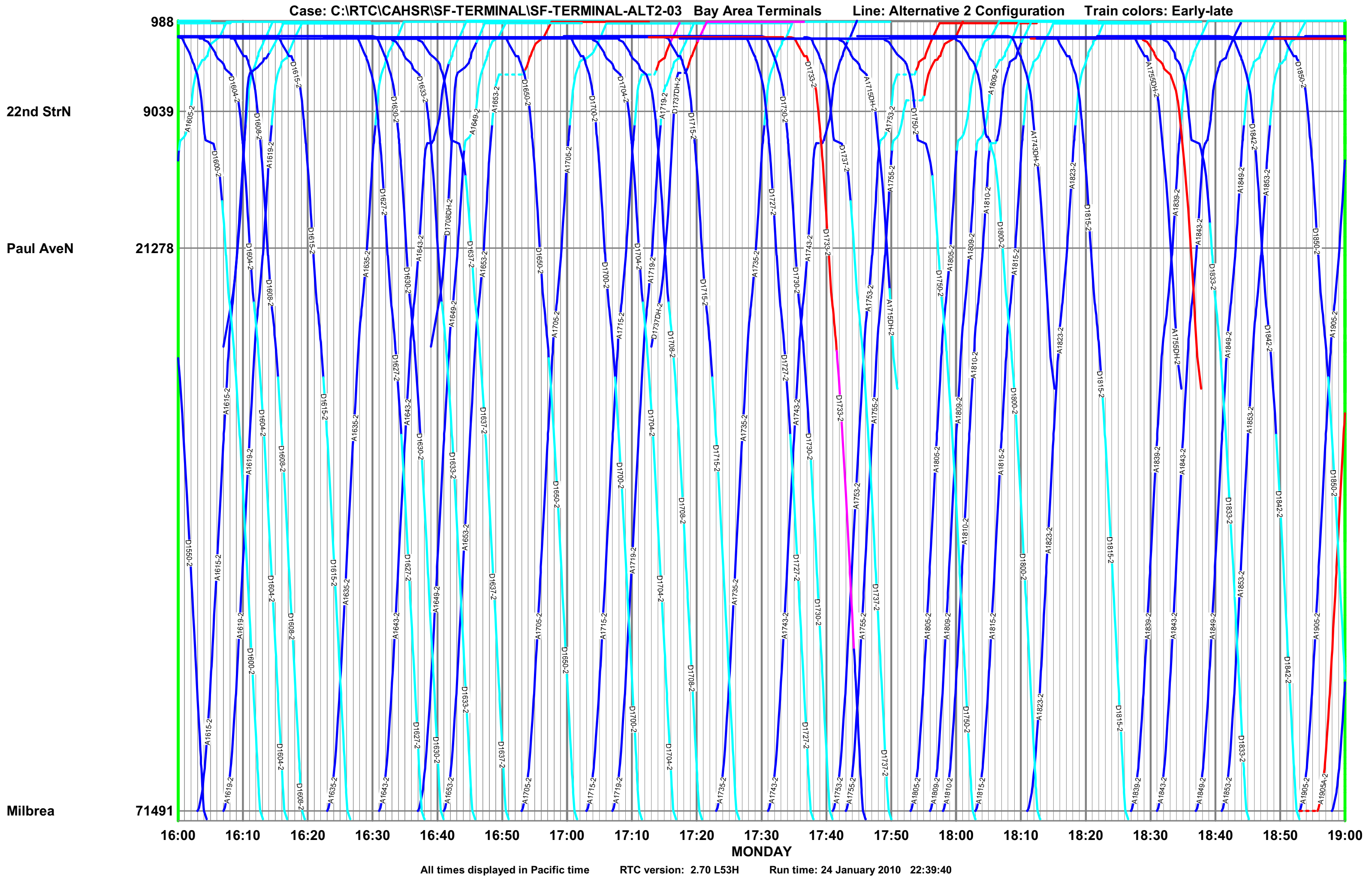
Paul AveN

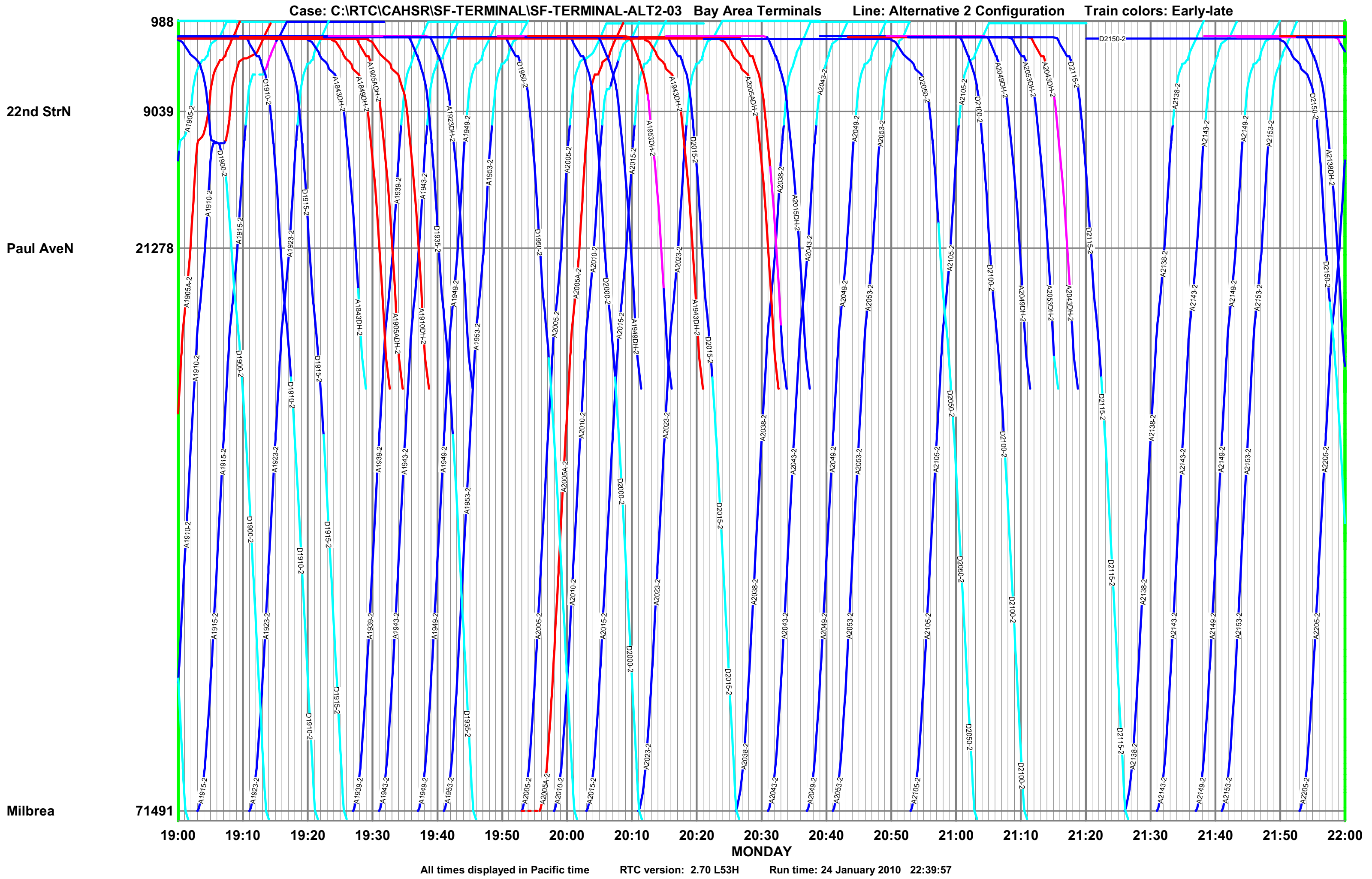
Milbrea





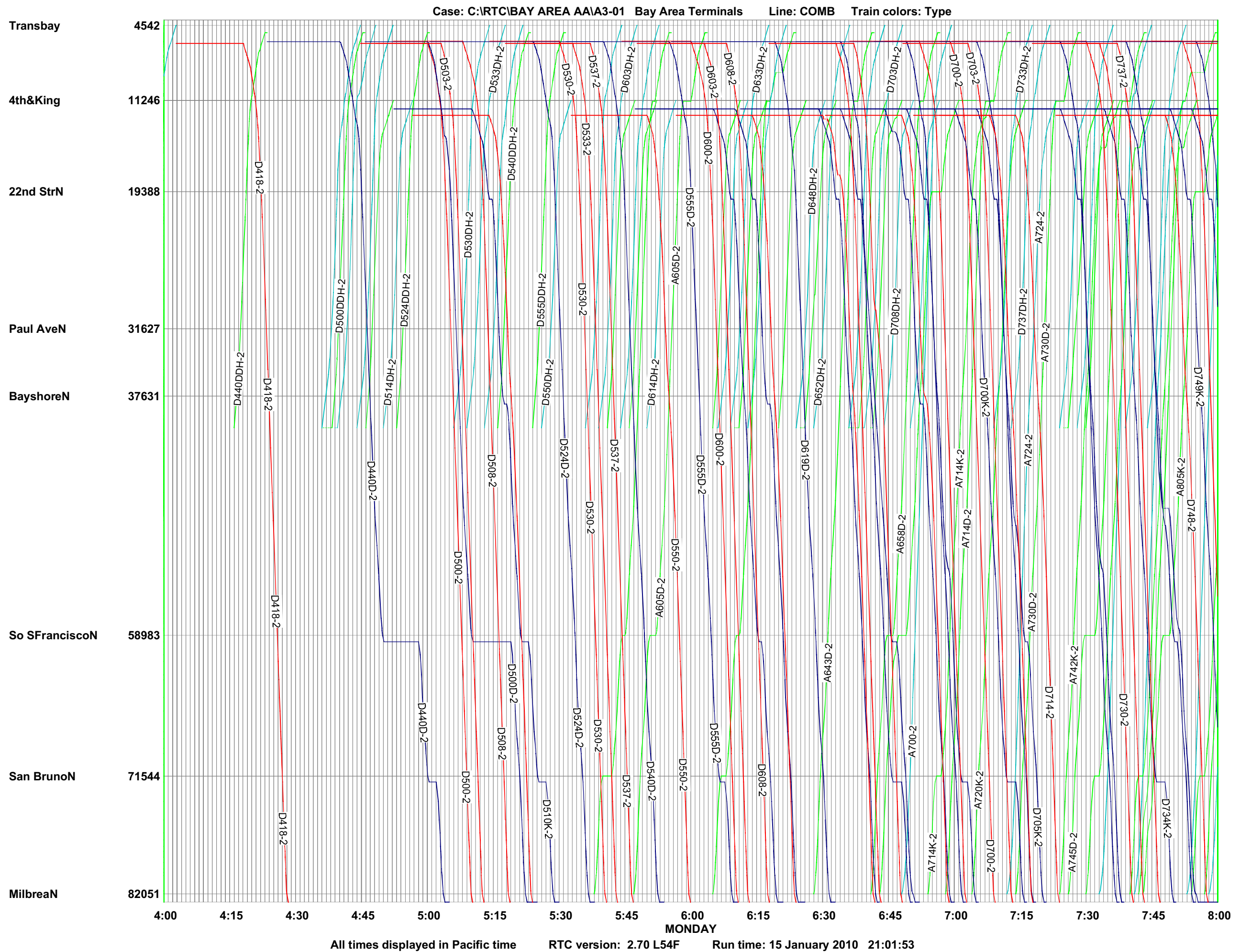






Train colors: Early-late

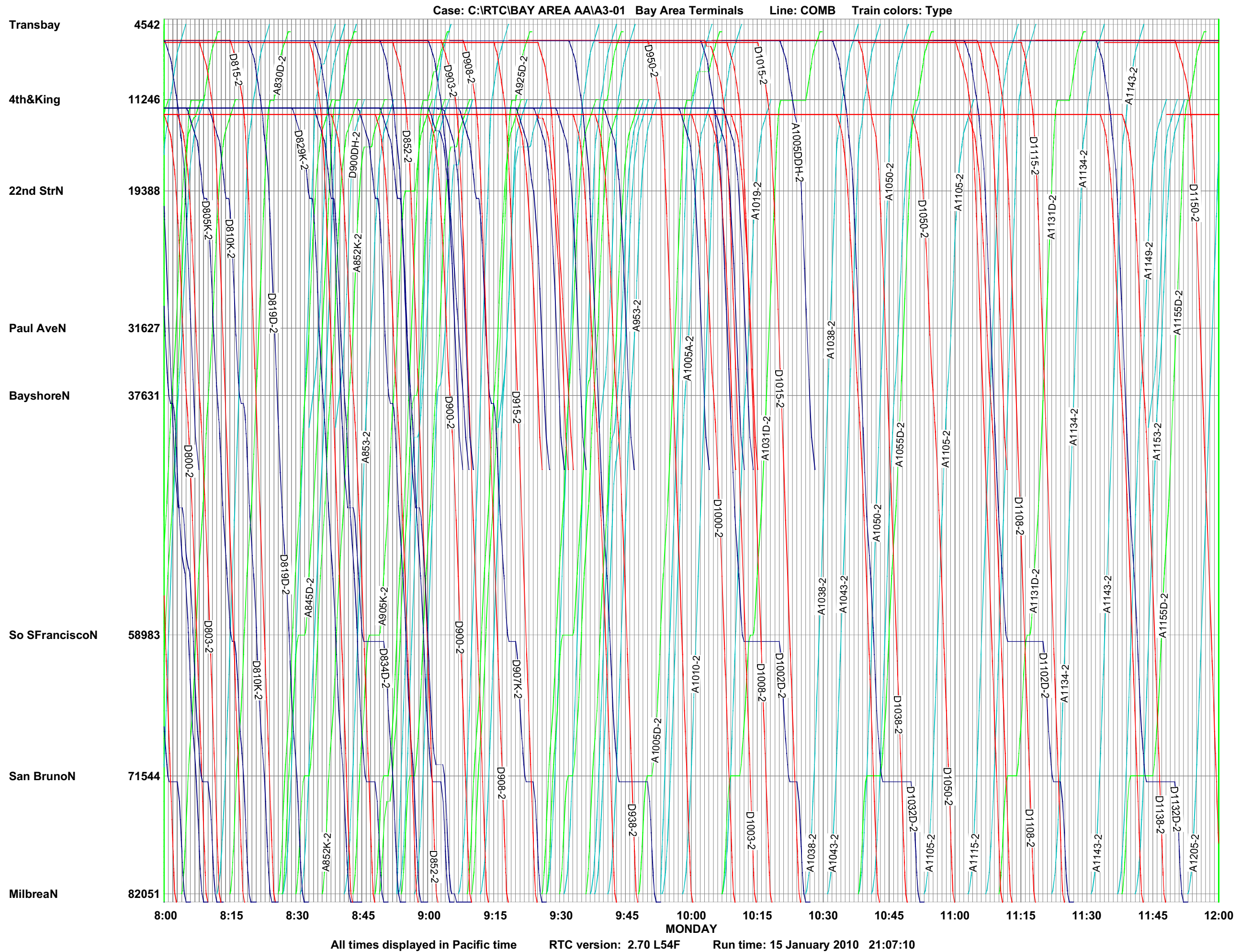


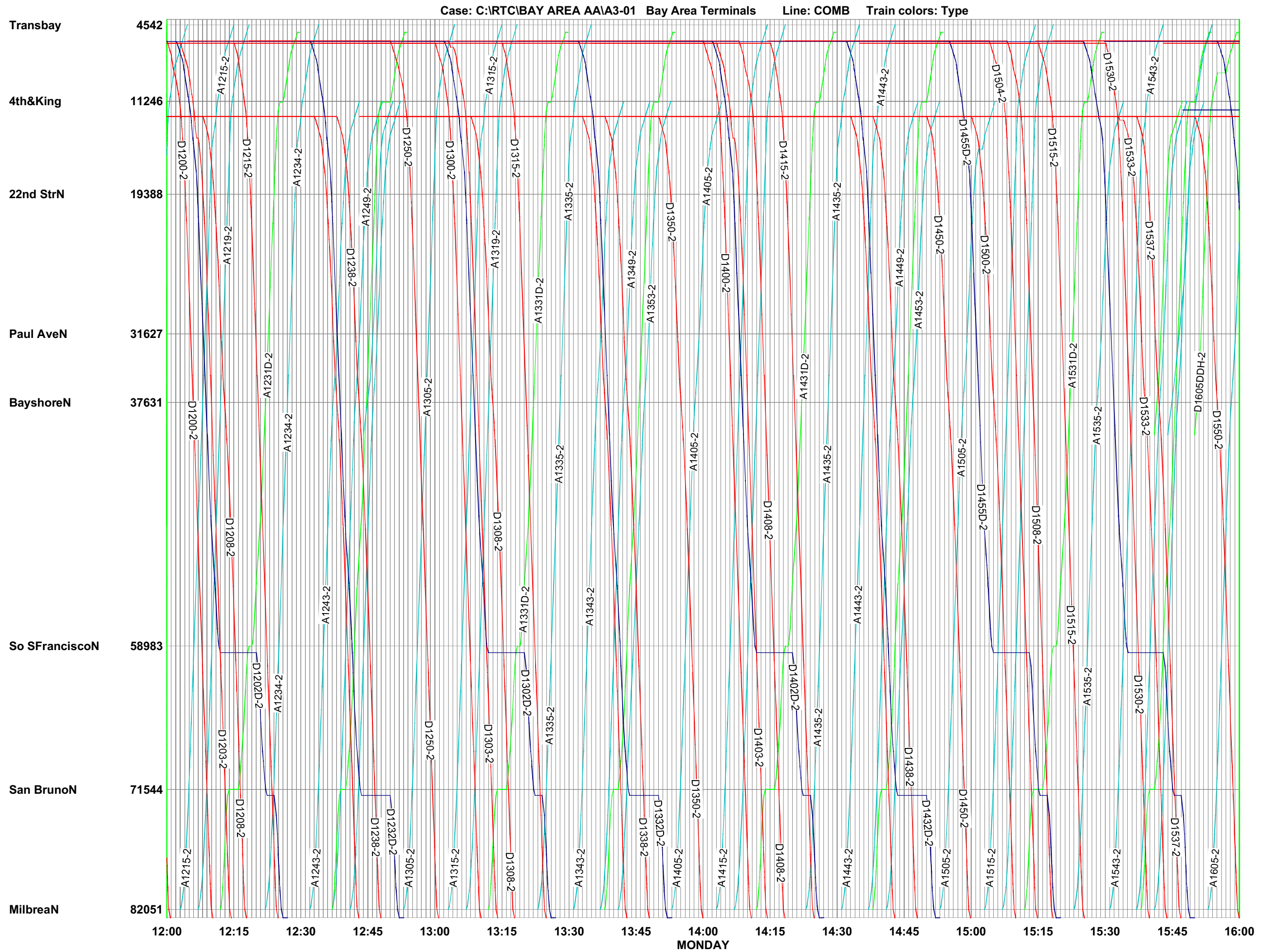


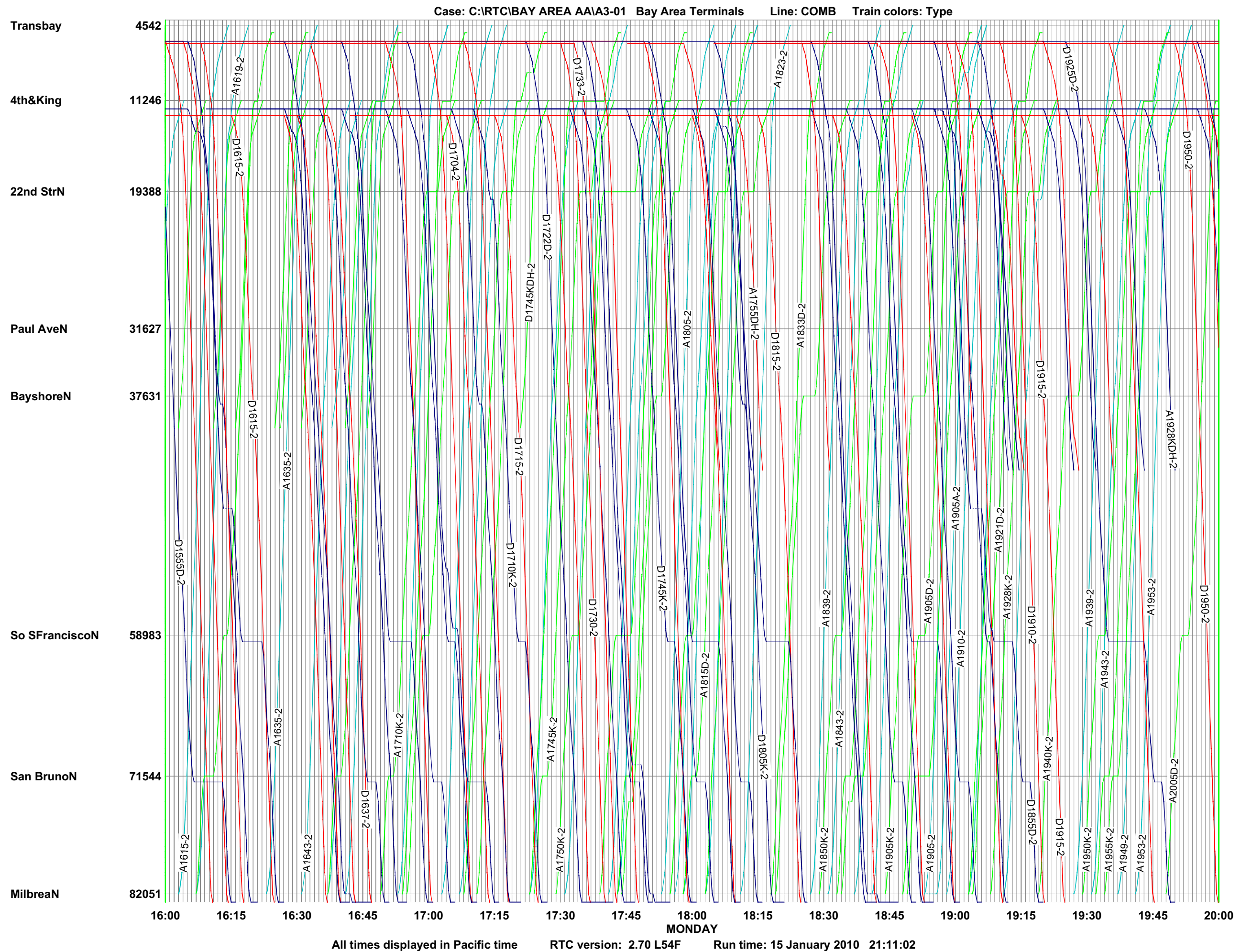
All times displayed in Pacific time

RTC version: 2.70 L54F

Run time: 15 January 2010 21:01:53



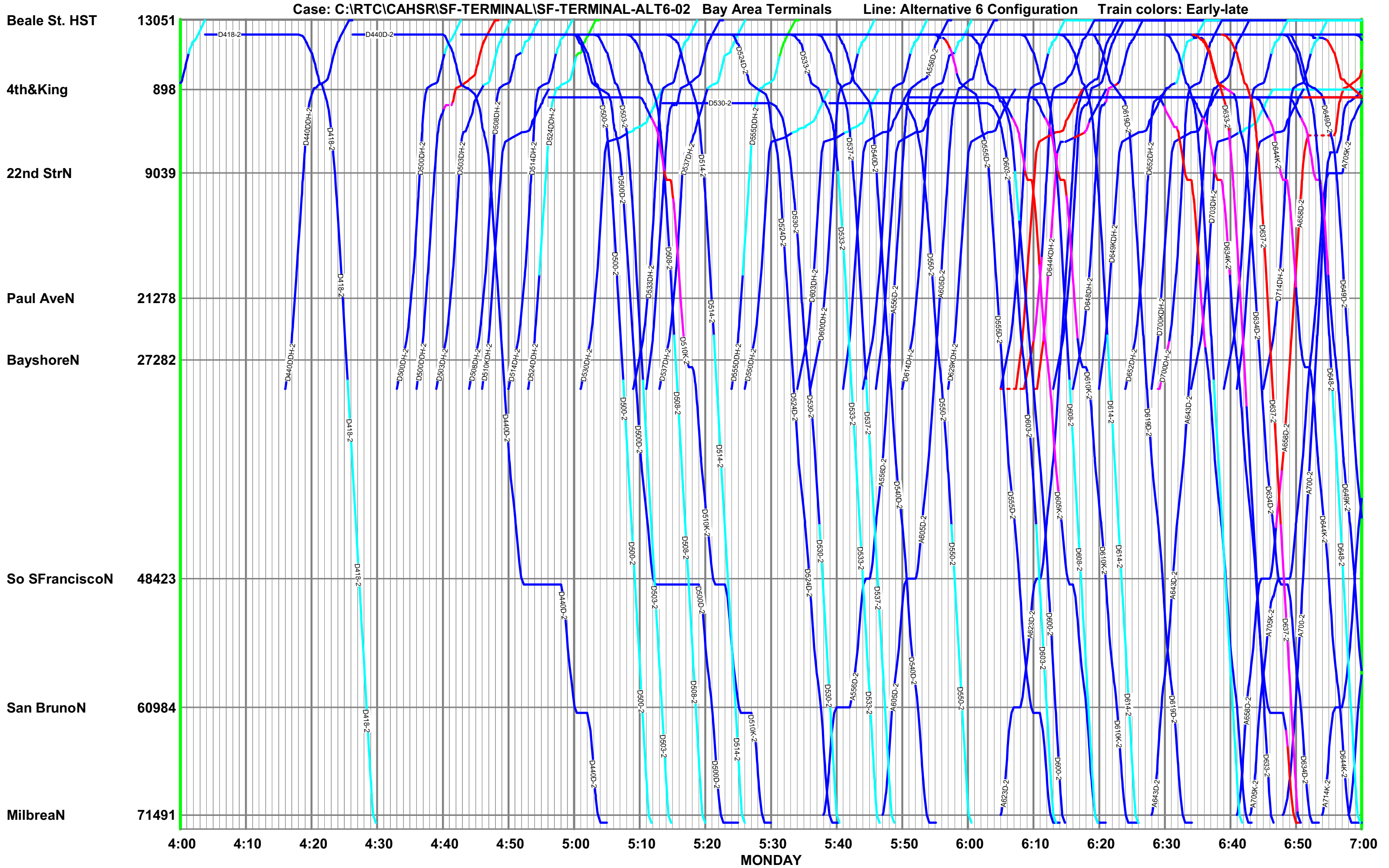


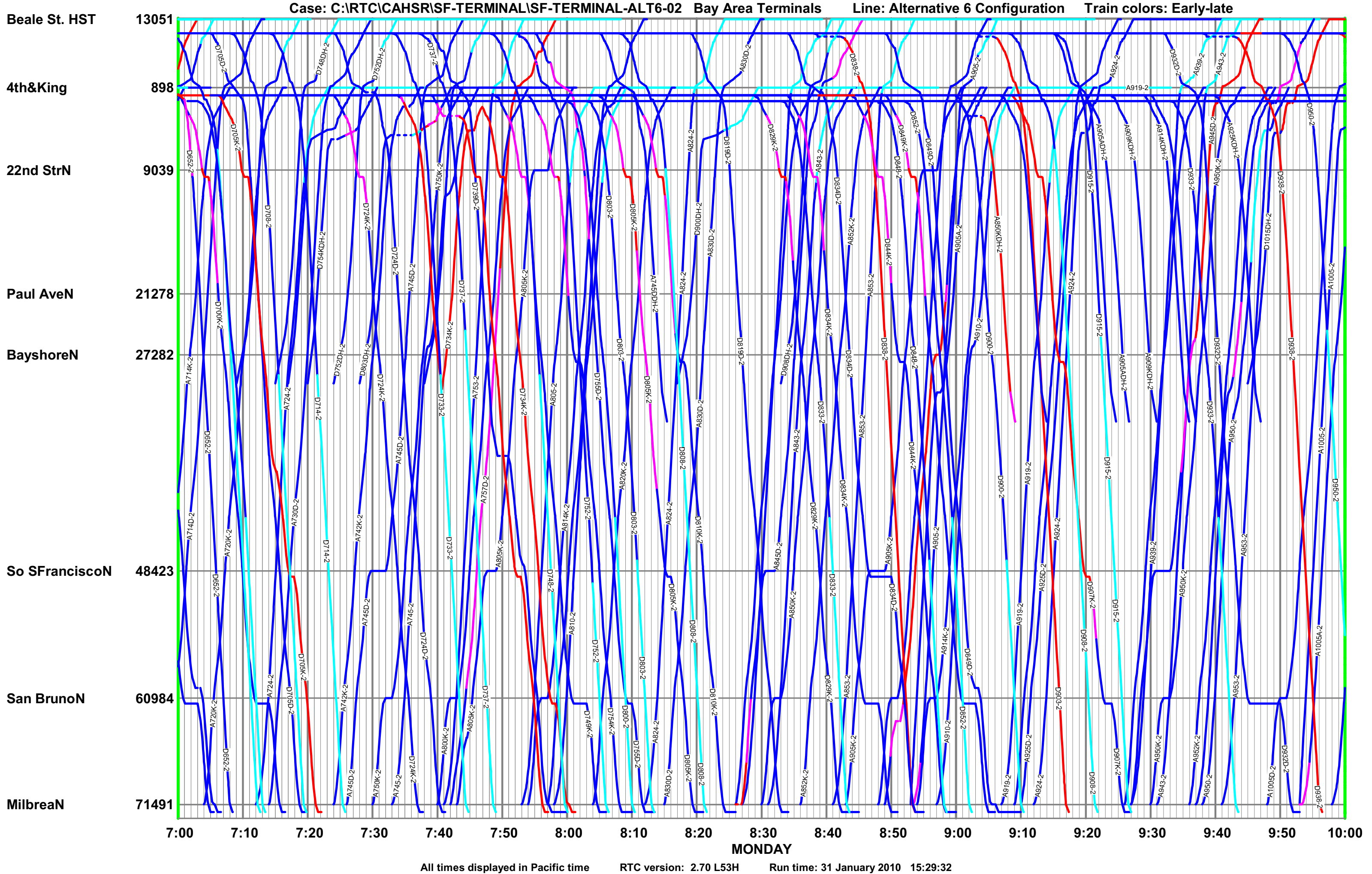


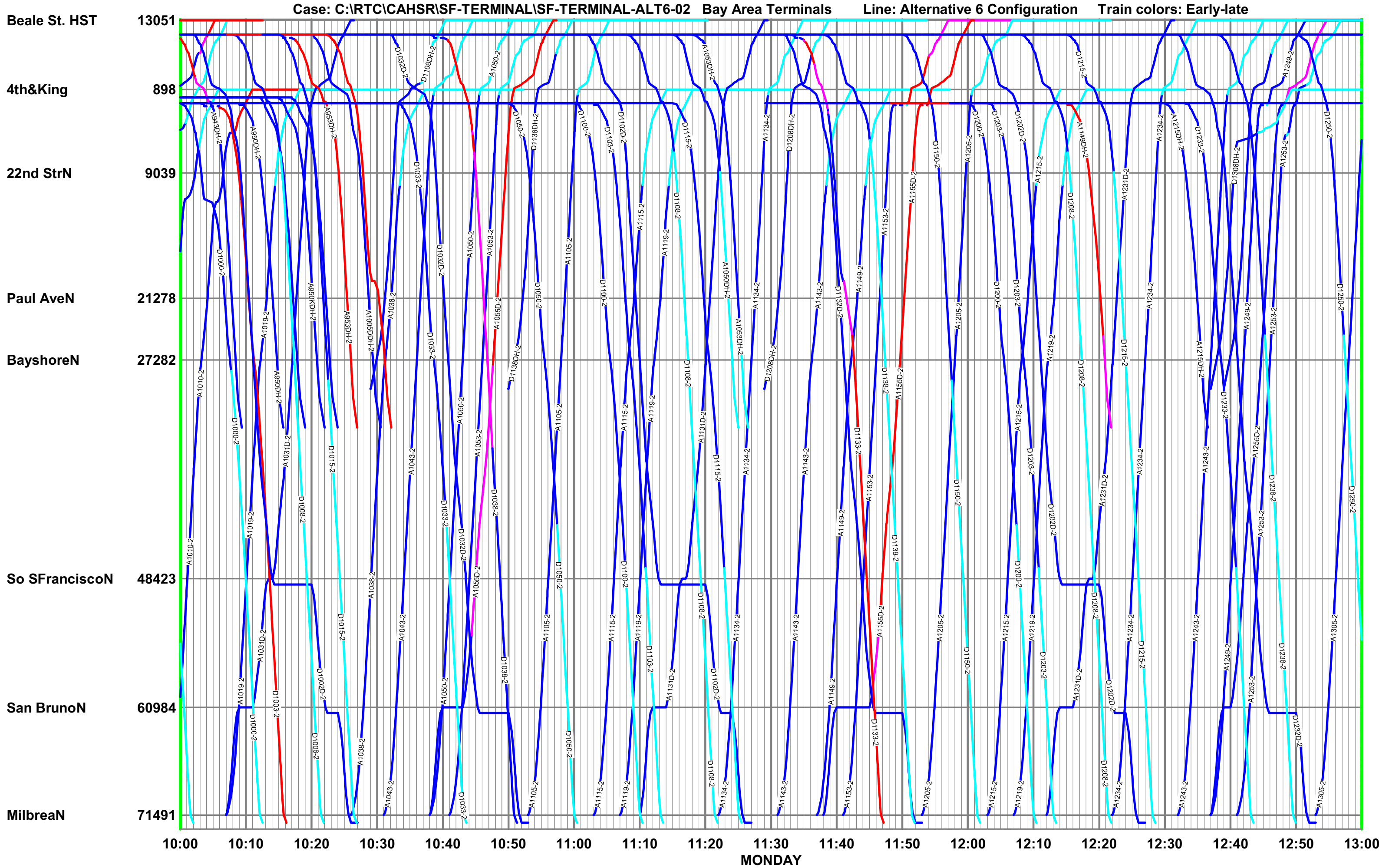
All times displayed in Pacific time

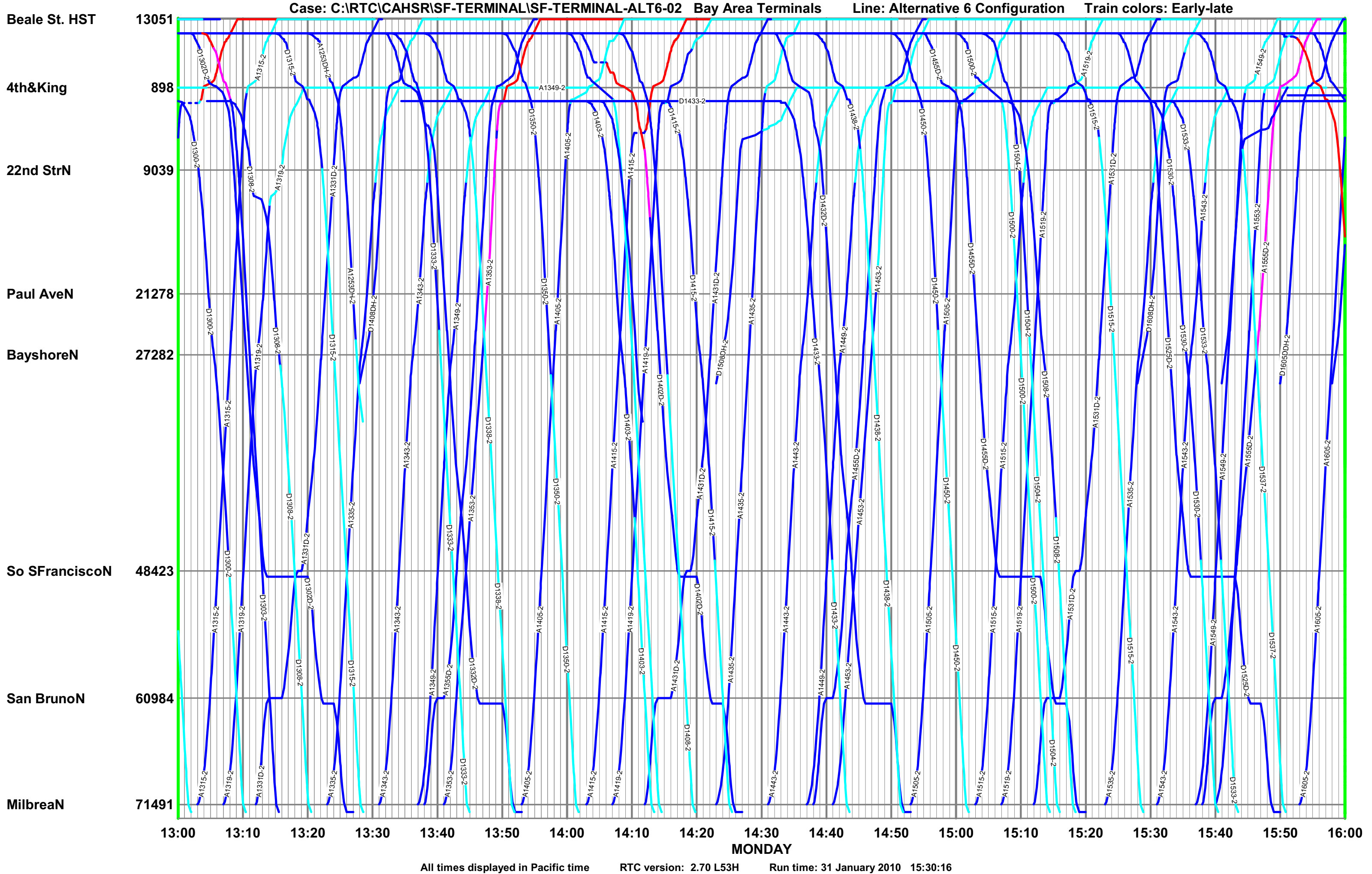
RTC version: 2.70 L54F

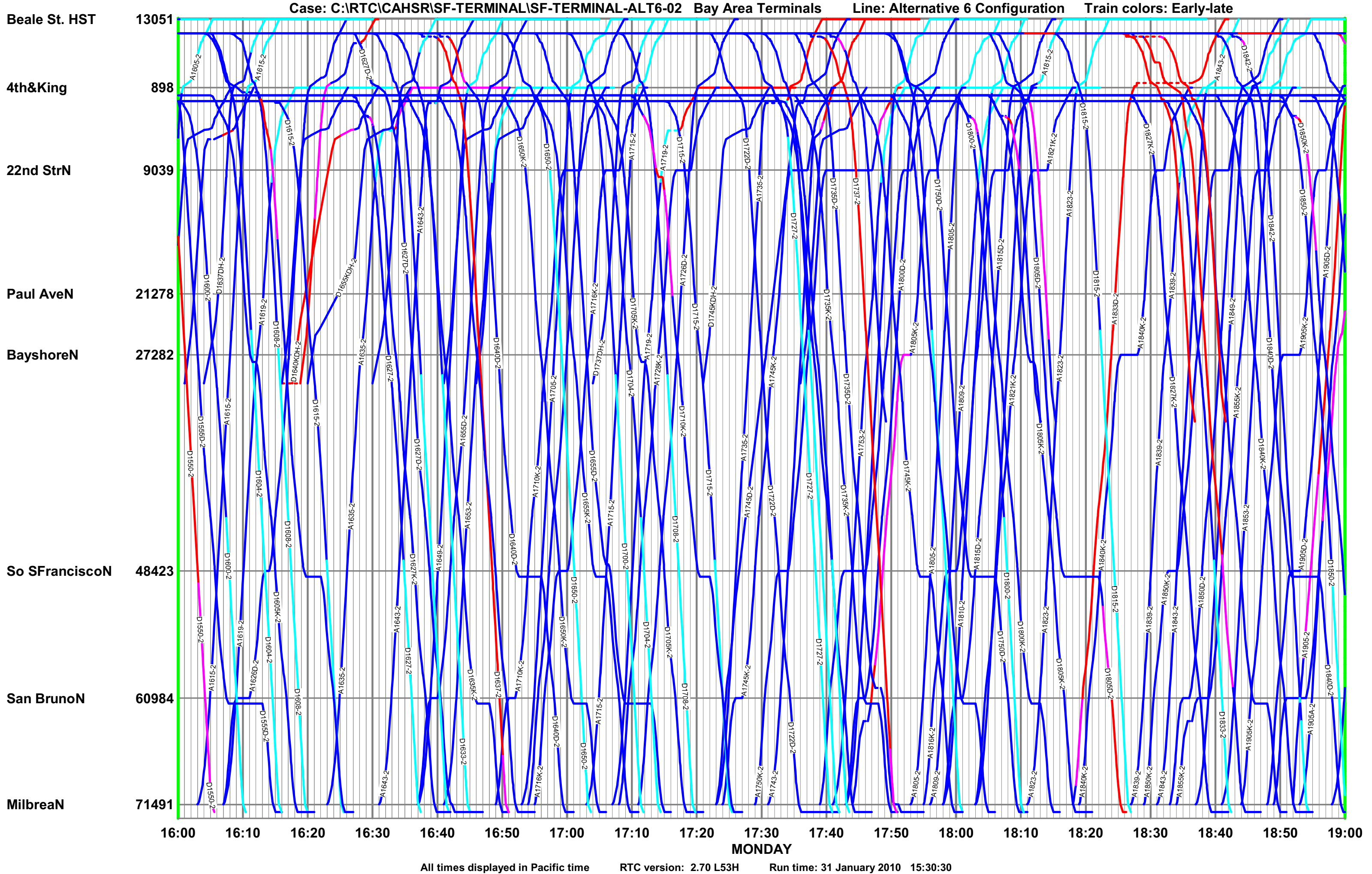
Run time: 15 January 2010 21:11:02

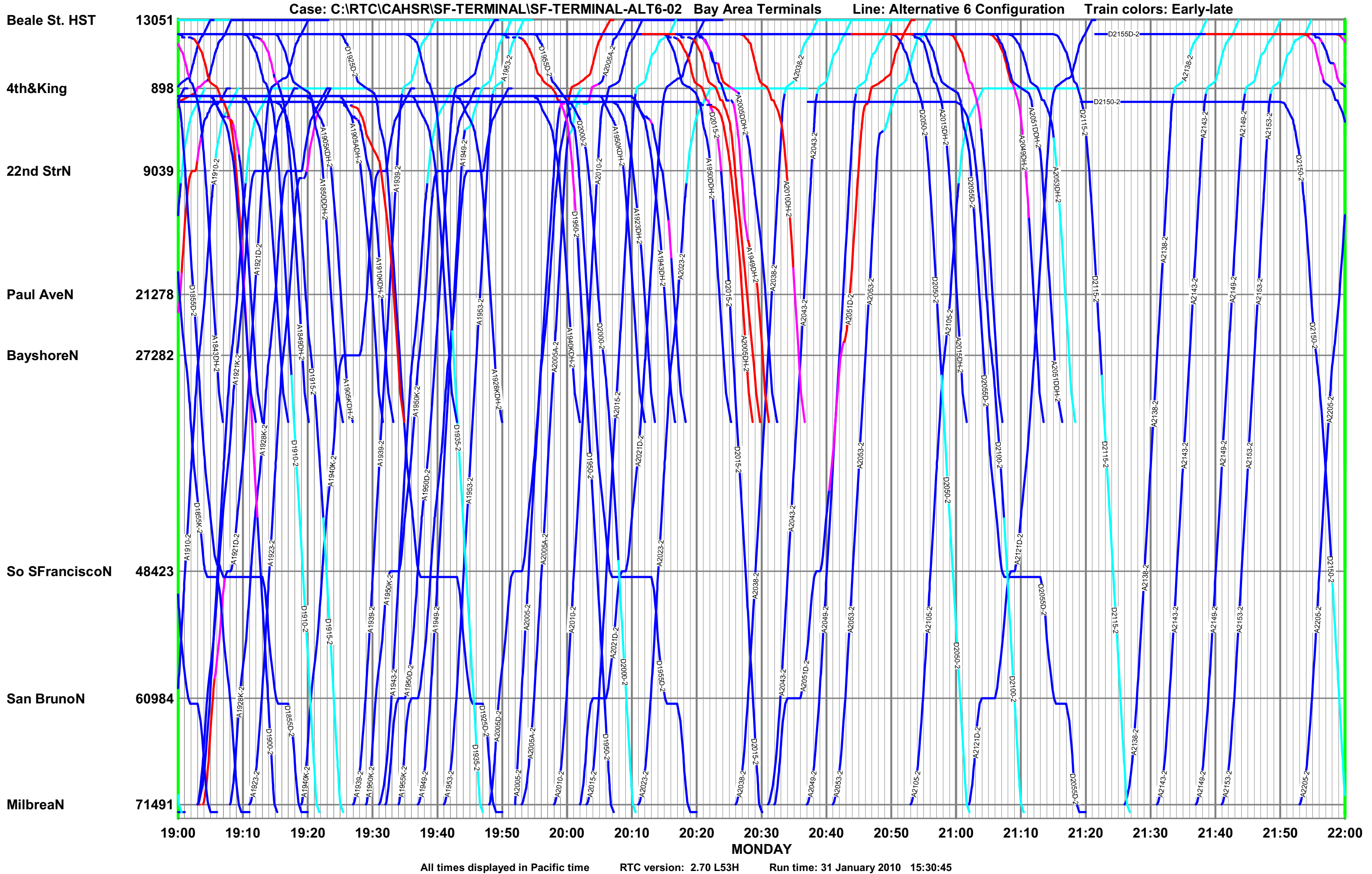


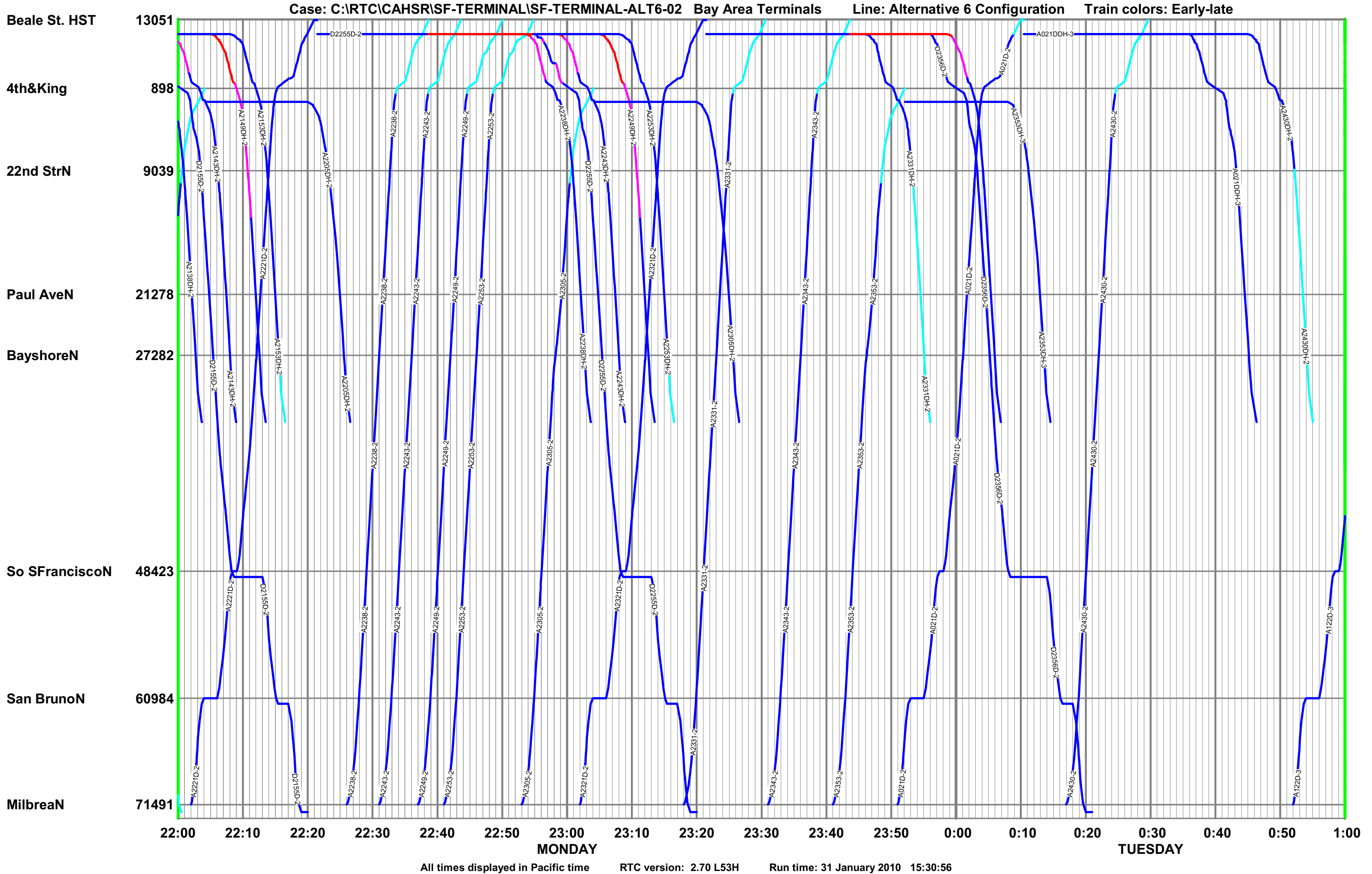




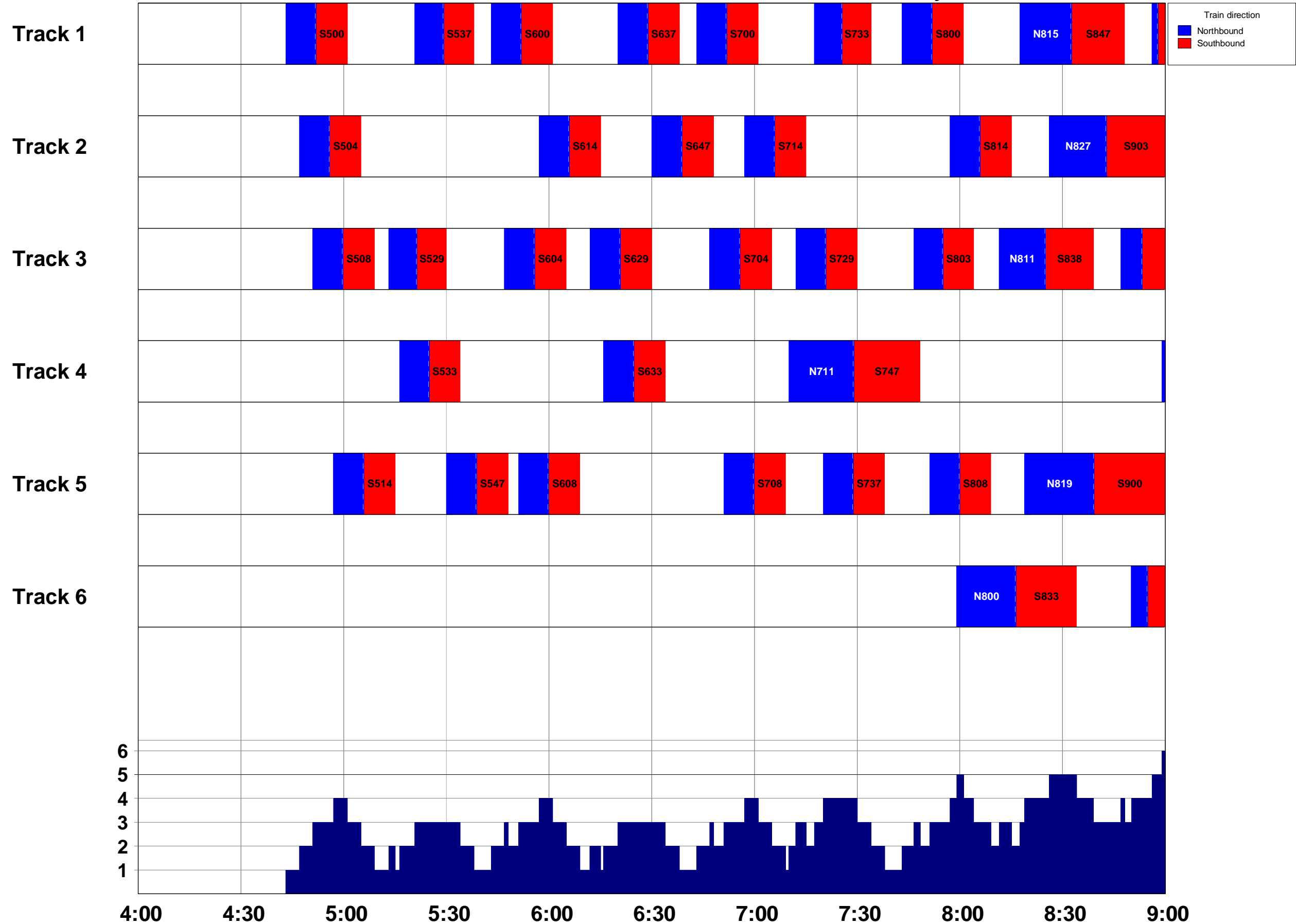








Case: C:\RTC\TRANSBAY09\T04a Track set: Transbay

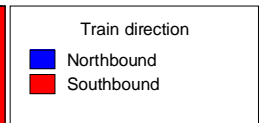
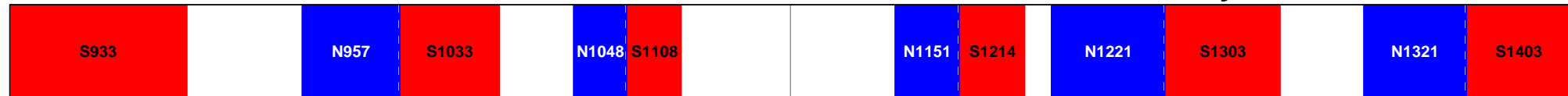


6 Track Transbay Terminal Configuration

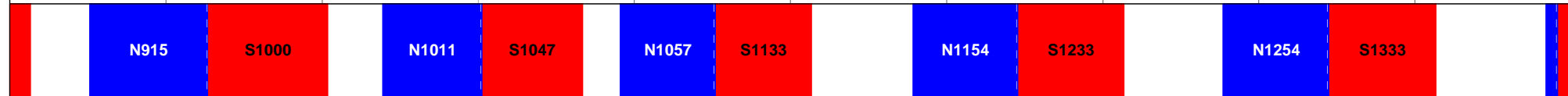
Case: C:\RTC\TRANSBAY09\T04a

Track set: Transbay

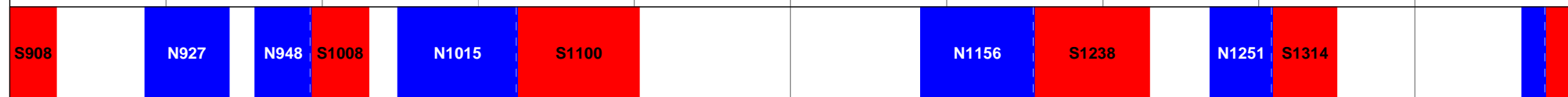
Track 1



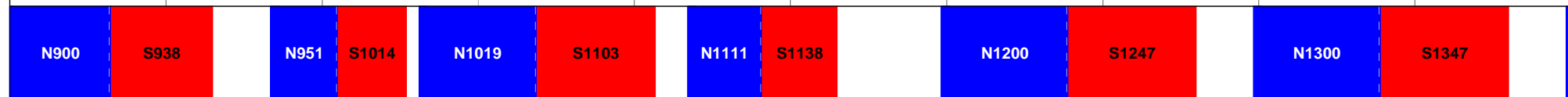
Track 2



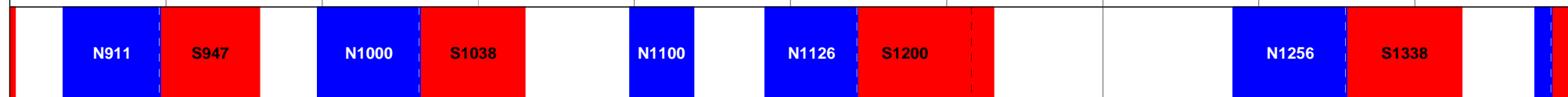
Track 3



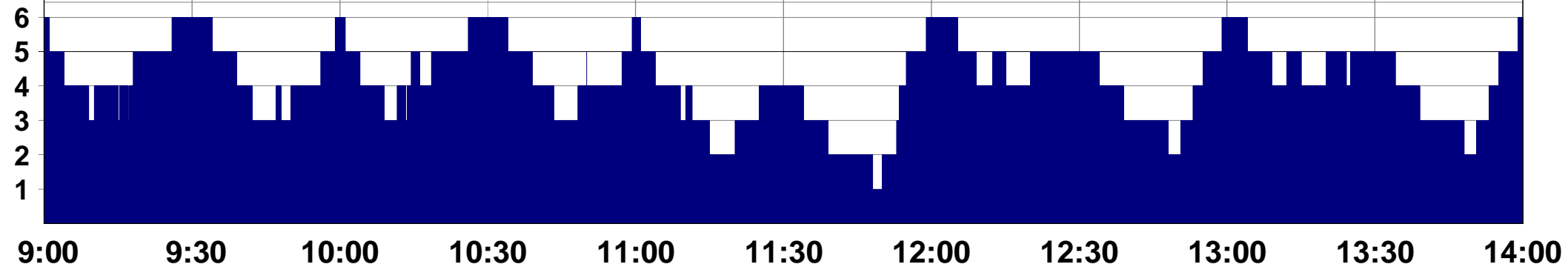
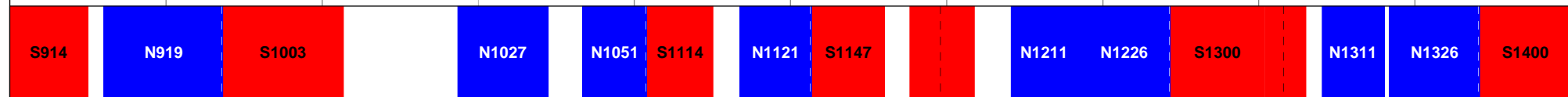
Track 4



Track 5



Track 6



6 Track Transbay Terminal Configuration

4th-King-Track2

4th-King-Track3

4th-King-Track4

4th-King-Track5

4th-King-Track6

4th-King-Track7

4th-King-Track8

4th-King-Track9

Train count

7

5

3

1

4:00

4:15

4:30

4:45

5:00

5:15

5:30

5:45

6:00

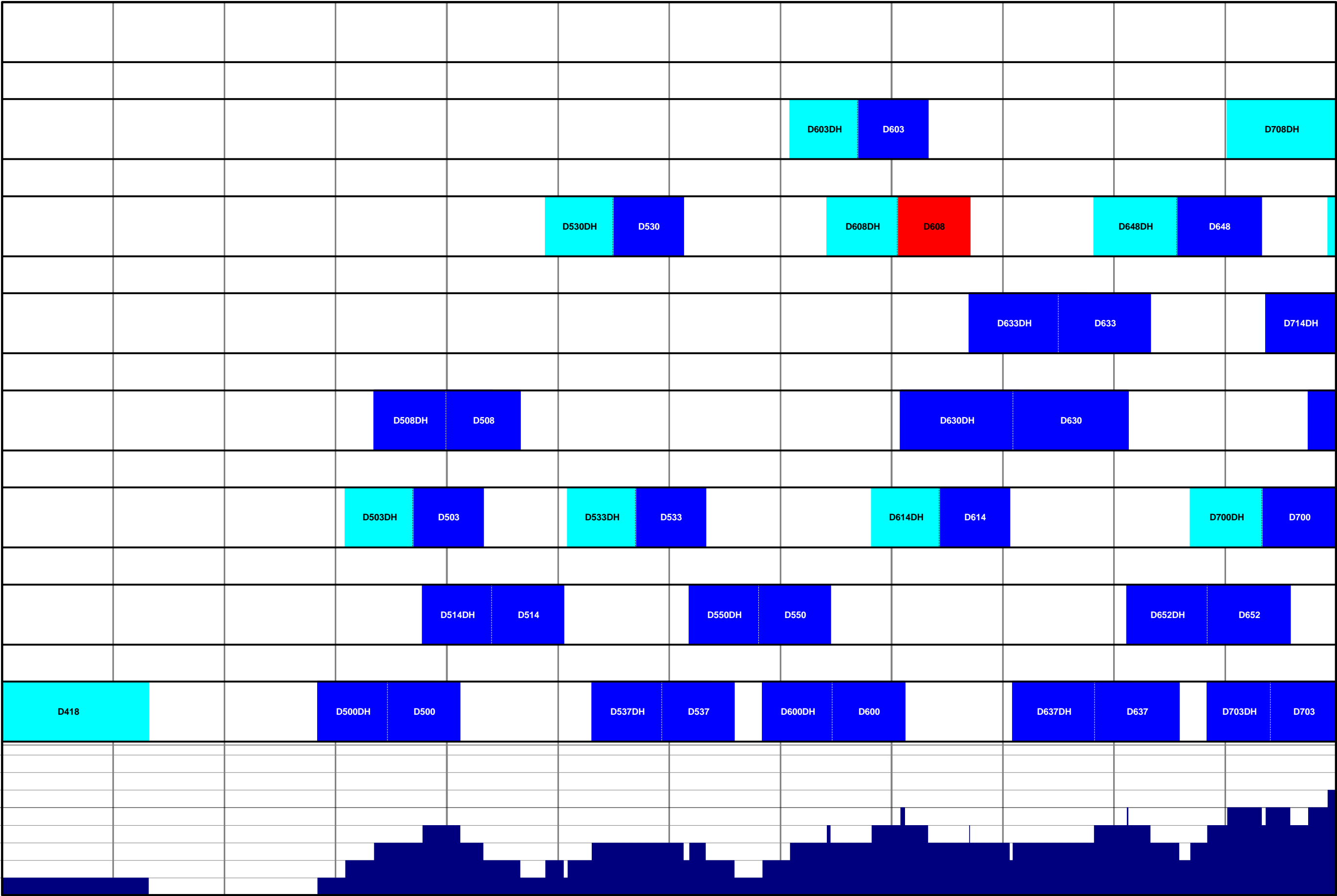
6:15

6:30

6:45

7:00

MONDAY



4th-King-Track2

4th-King-Track3

4th-King-Track4

4th-King-Track5

4th-King-Track6

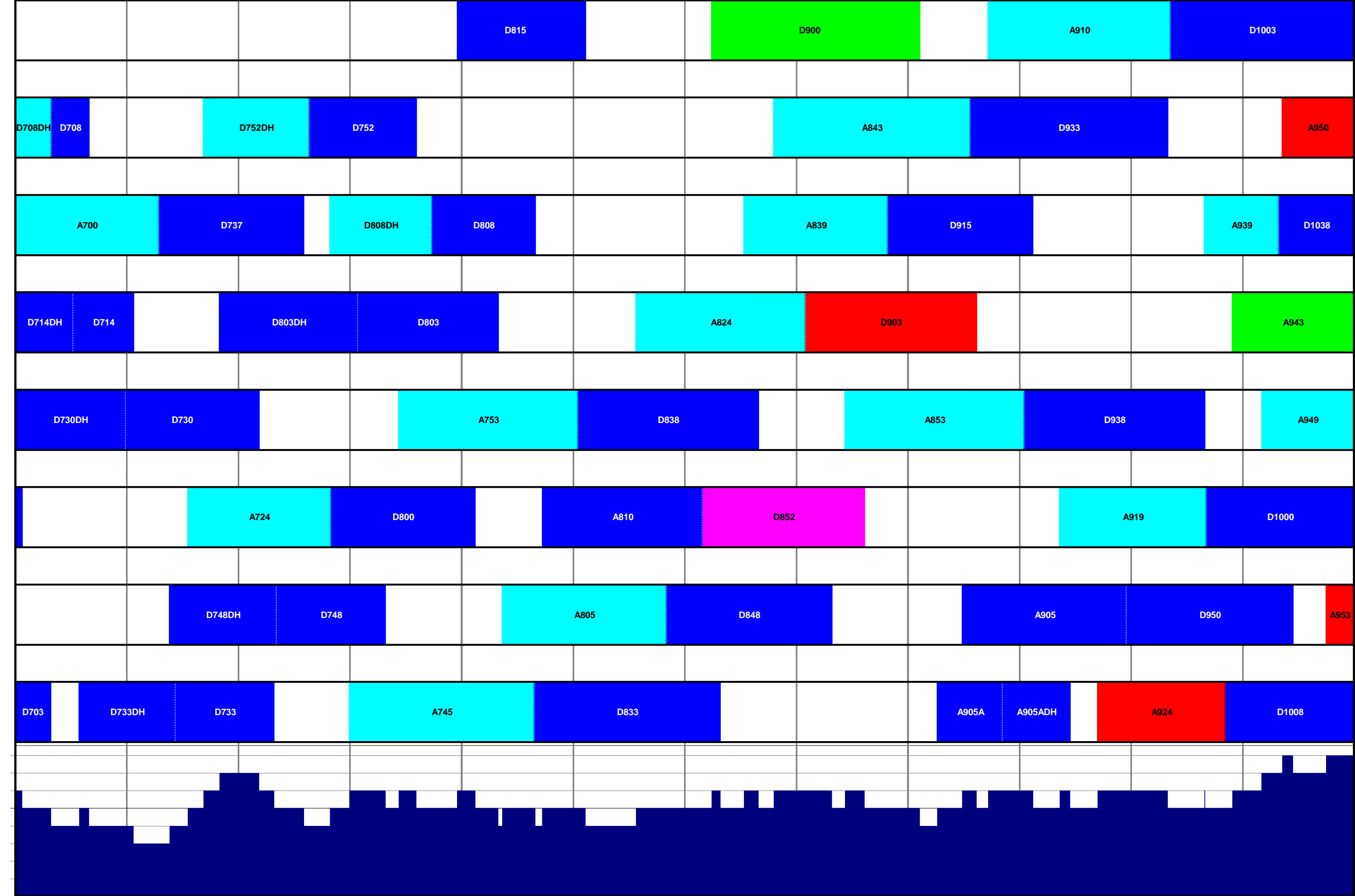
4th-King-Track7

4th-King-Track8

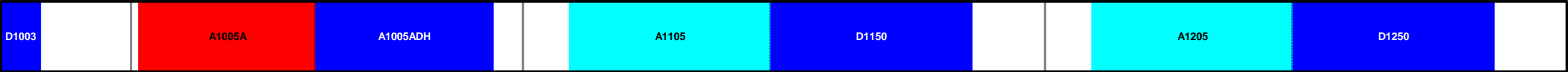
4th-King-Track9

Train count

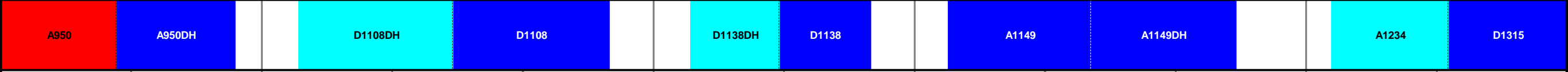
7
5
3
1



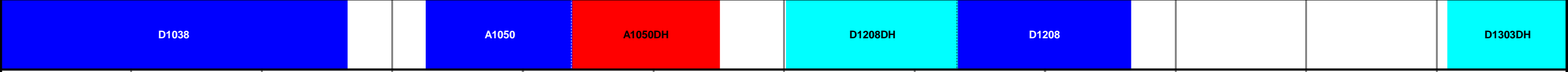
4th-King-Track2



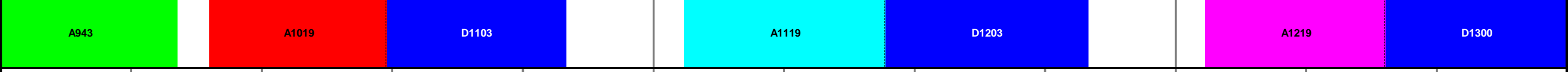
4th-King-Track3



4th-King-Track4



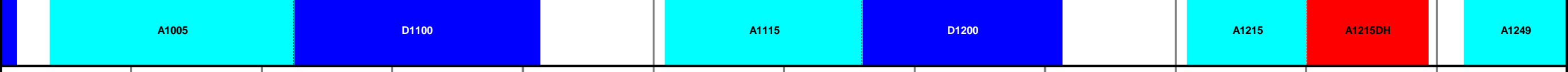
4th-King-Track5



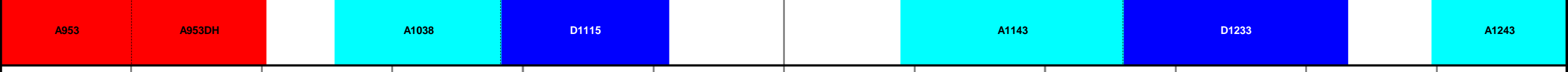
4th-King-Track6



4th-King-Track7



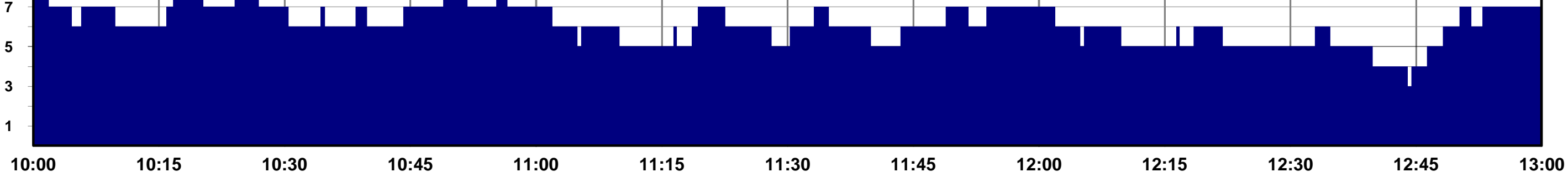
4th-King-Track8



4th-King-Track9

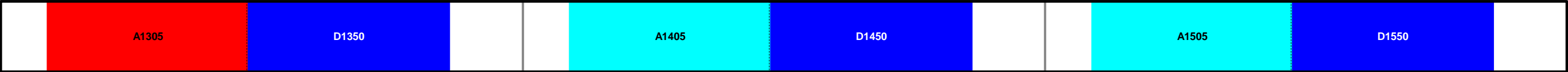


Train count



MONDAY

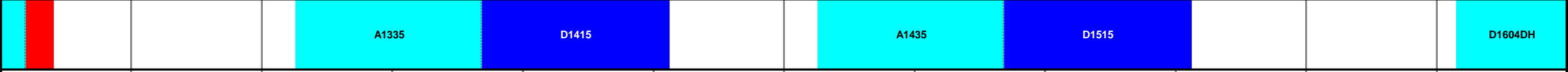
4th-King-Track2



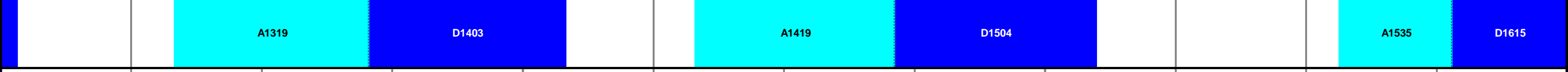
4th-King-Track3



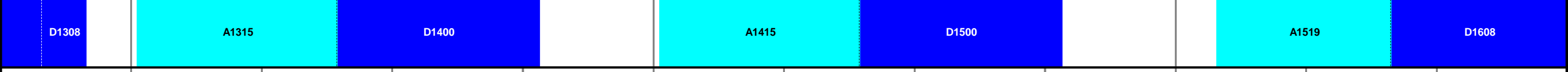
4th-King-Track4



4th-King-Track5



4th-King-Track6



4th-King-Track7



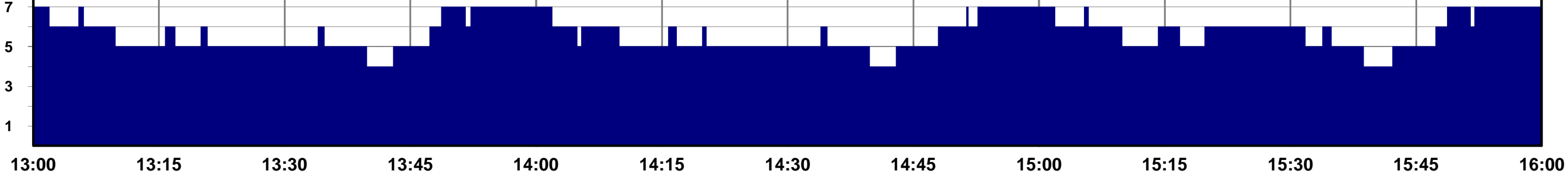
4th-King-Track8



4th-King-Track9

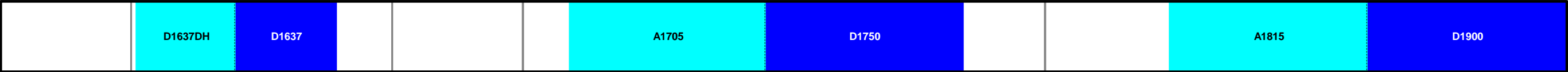


Train count

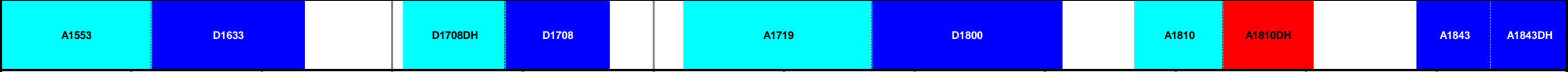


MONDAY

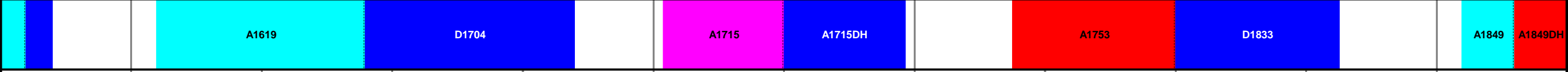
4th-King-Track2



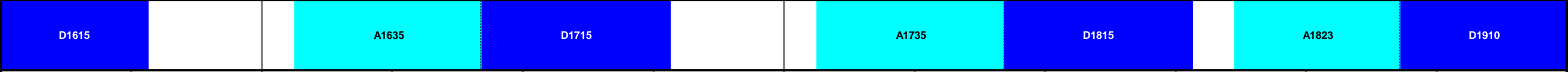
4th-King-Track3



4th-King-Track4



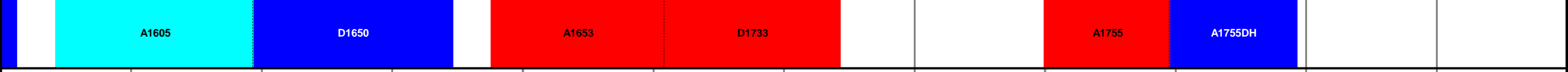
4th-King-Track5



4th-King-Track6



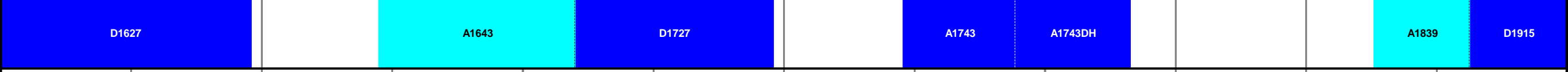
4th-King-Track7



4th-King-Track8

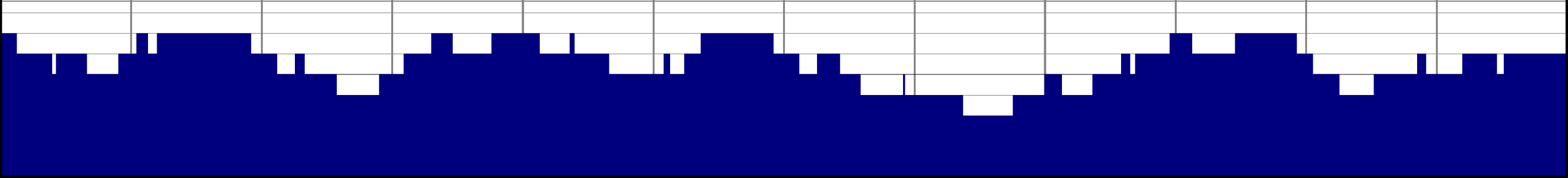


4th-King-Track9



Train count

7
5
3
1



16:00 16:15 16:30 16:45 17:00 17:15 17:30 17:45 18:00 18:15 18:30 18:45 19:00

MONDAY

4th-King-Track2

4th-King-Track3

4th-King-Track4

4th-King-Track5

4th-King-Track6

4th-King-Track7

4th-King-Track8

4th-King-Track9

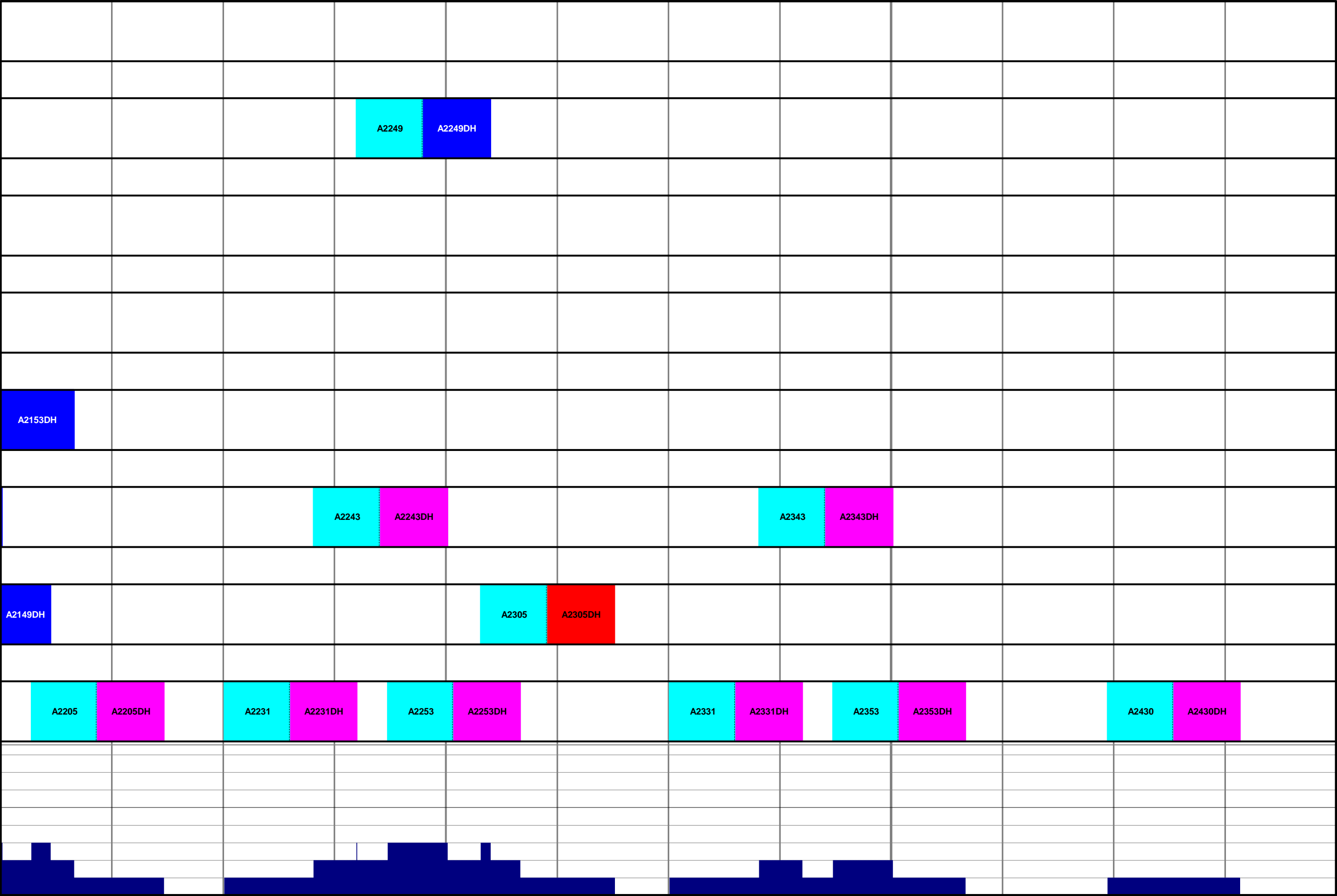
Train count

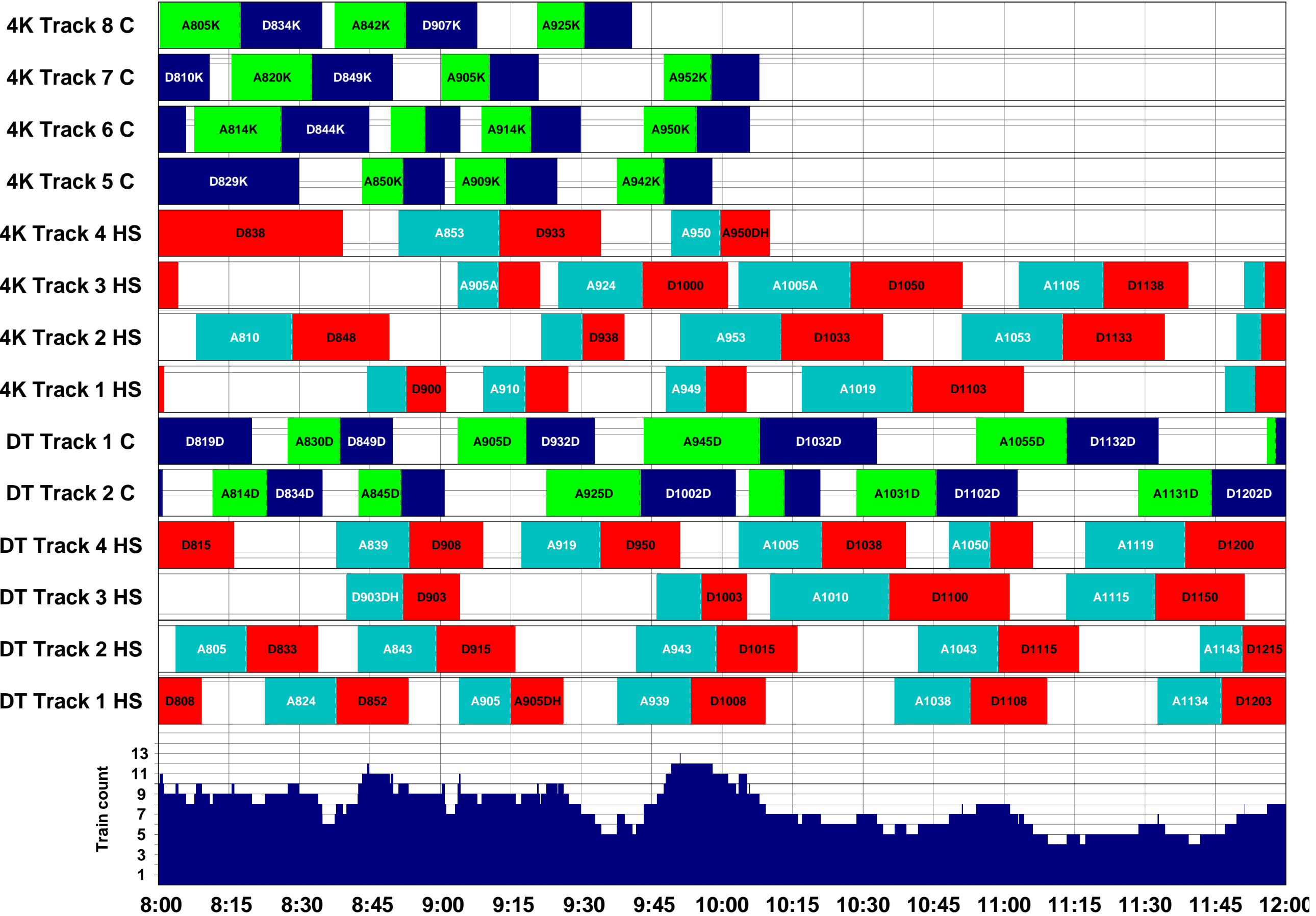
7
5
3
1

22:00 22:15 22:30 22:45 23:00 23:15 23:30 23:45 0:00 0:15 0:30 0:45 1:00

MONDAY

TUESDAY





4K Track 8 C

4K Track 7 C

4K Track 6 C

4K Track 5 C

4K Track 4 HS

4K Track 3 HS

4K Track 2 HS

4K Track 1 HS

DT Track 1 C

DT Track 2 C

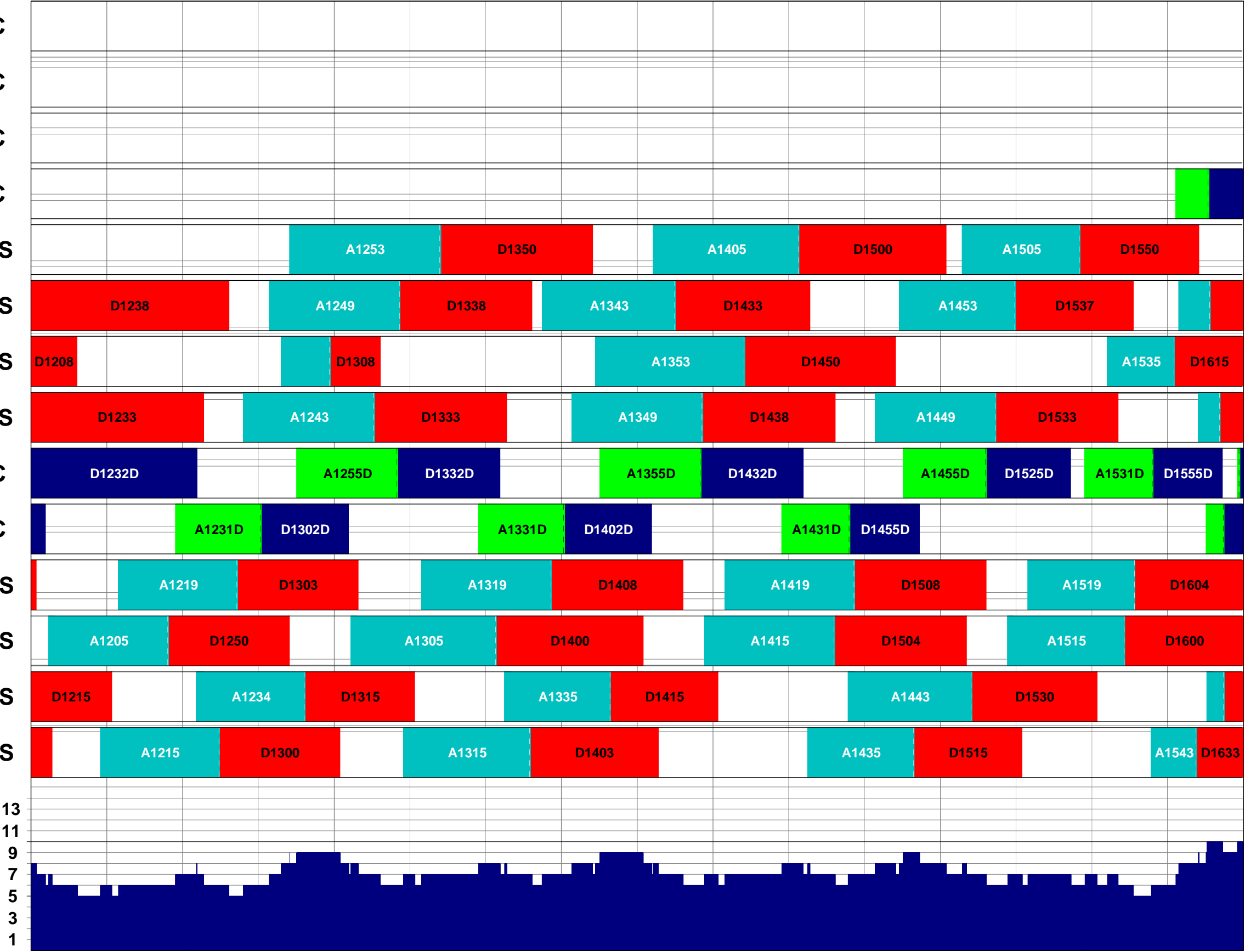
DT Track 4 HS

DT Track 3 HS

DT Track 2 HS

DT Track 1 HS

Train count



12:00 12:15 12:30 12:45 13:00 13:15 13:30 13:45 14:00 14:15 14:30 14:45 15:00 15:15 15:30 15:45 16:00

MONDAY

4K Track 8 C

4K Track 7 C

4K Track 6 C

4K Track 5 C

4K Track 4 HS

4K Track 3 HS

4K Track 2 HS

4K Track 1 HS

DT Track 1 C

DT Track 2 C

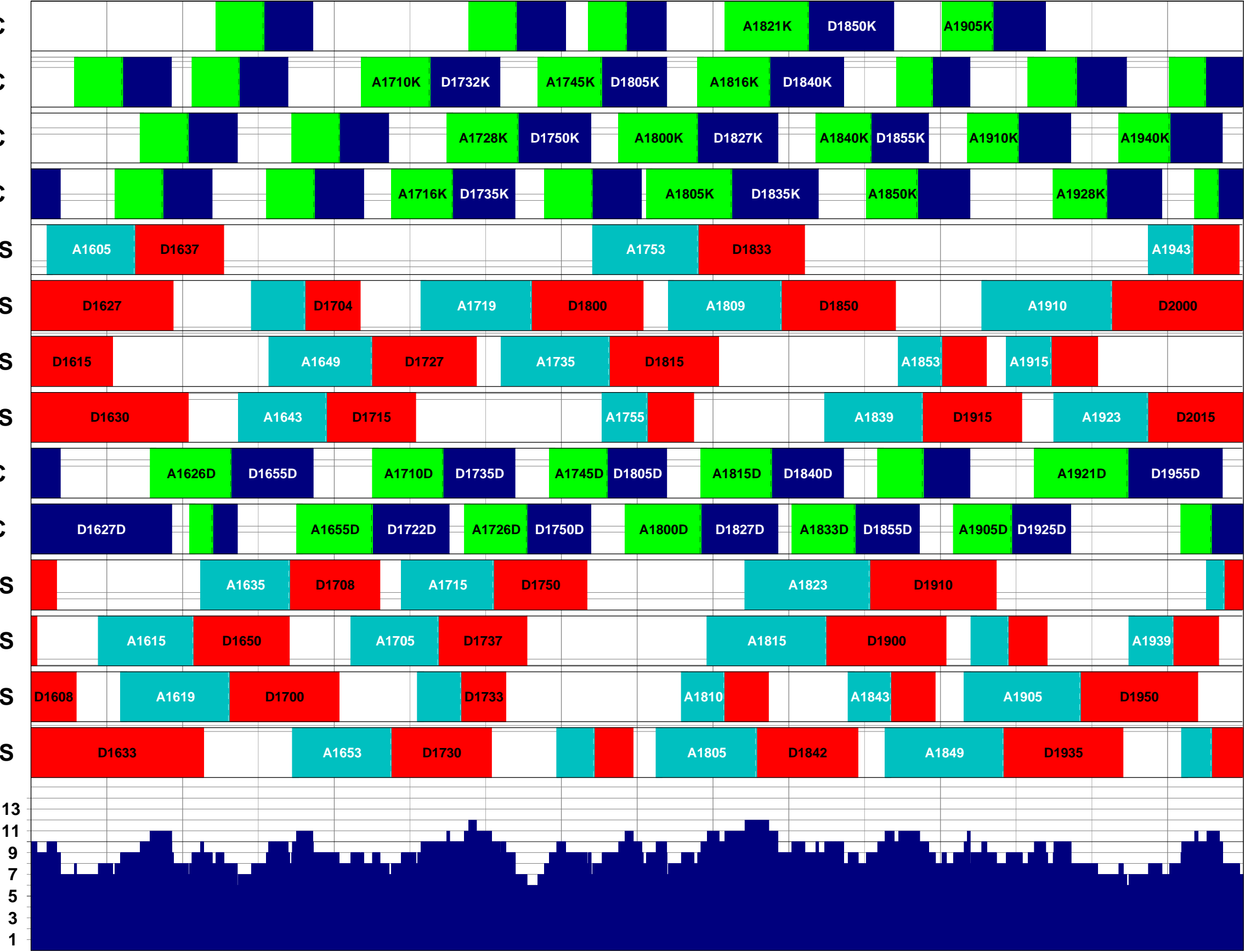
DT Track 4 HS

DT Track 3 HS

DT Track 2 HS

DT Track 1 HS

Train count



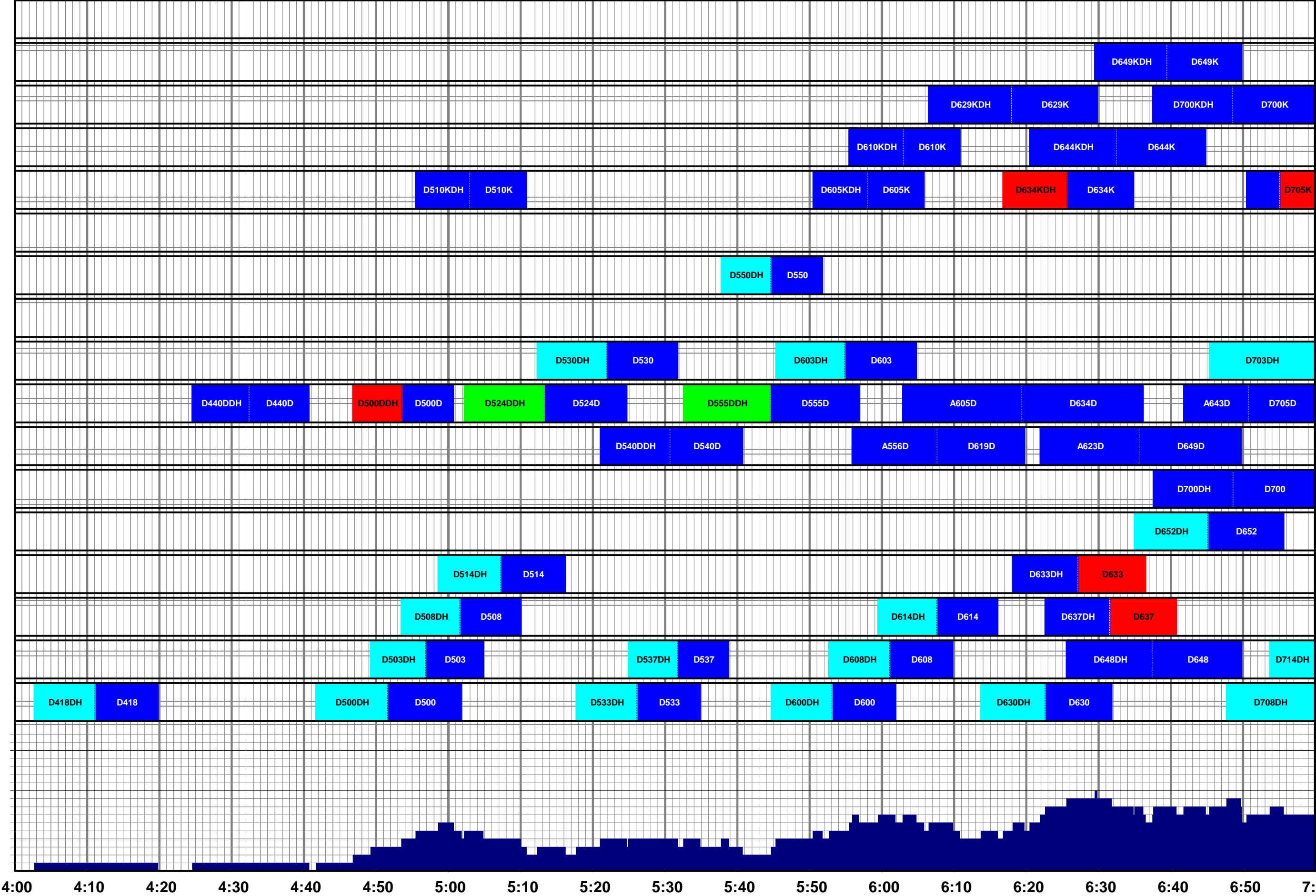
16:00 16:15 16:30 16:45 17:00 17:15 17:30 17:45 18:00 18:15 18:30 18:45 19:00 19:15 19:30 19:45 20:00

MONDAY

4-King-Caltrain1
4-King-Caltrain2
4-King-Caltrain3
4-King-Caltrain4
4-King-Caltrain5
4-King-CHST1
4-King-CHST2
4-King-CHST3
4-King-CHST4
Beale-Caltrain1
Beale-Caltrain2
Beale-CHST1
Beale-CHST2
Beale-CHST3
Beale-CHST4
Beale-CHST5
Beale-CHST6

17
15
13
11
9
7
5
3
1

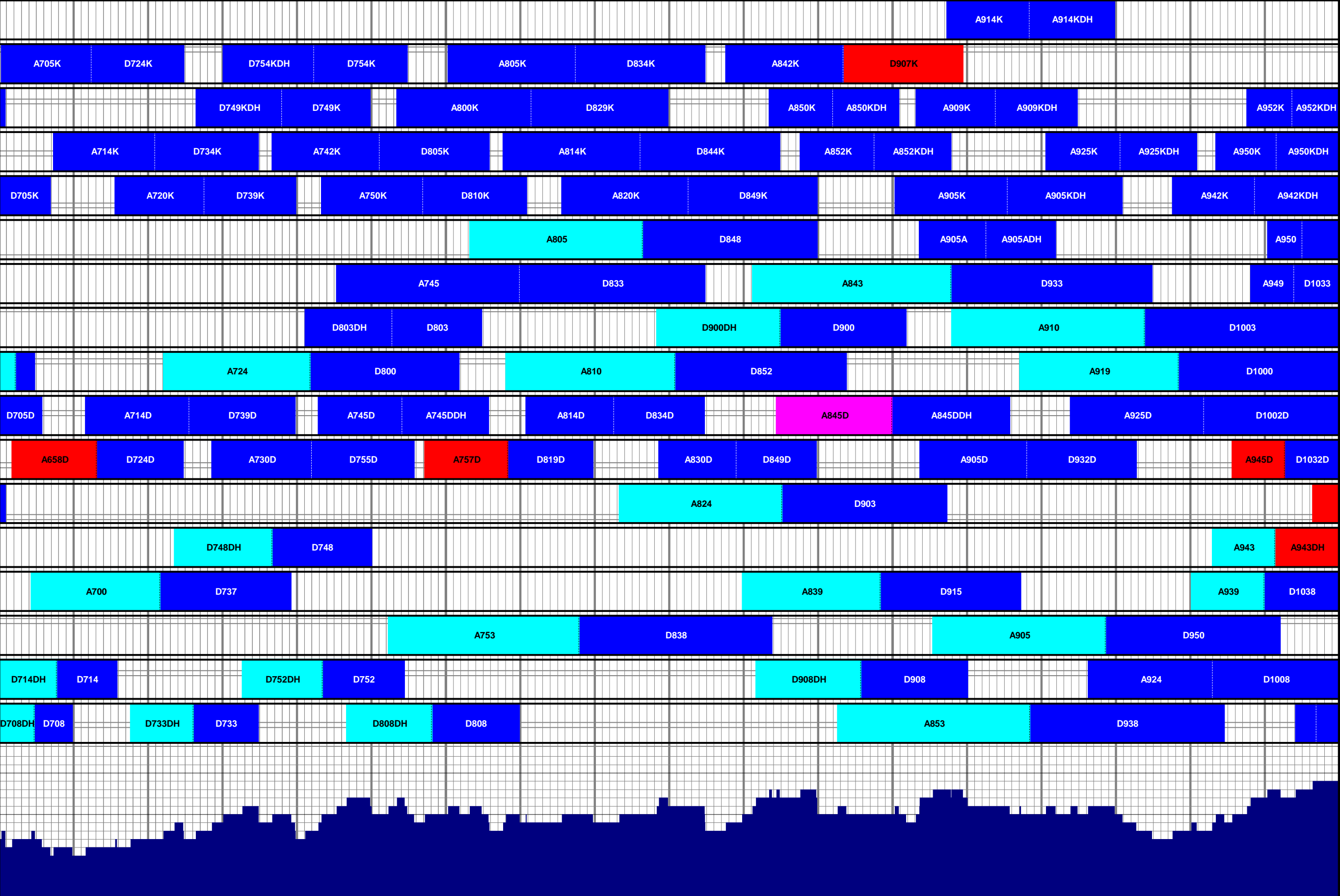
Train count



MONDAY

4-King-Caltrain1
4-King-Caltrain2
4-King-Caltrain3
4-King-Caltrain4
4-King-Caltrain5
4-King-CHST1
4-King-CHST2
4-King-CHST3
4-King-CHST4
Beale-Caltrain1
Beale-Caltrain2
Beale-CHST1
Beale-CHST2
Beale-CHST3
Beale-CHST4
Beale-CHST5
Beale-CHST6

17
15
13
11
9
7
5
3
1



7:00 7:10 7:20 7:30 7:40 7:50 8:00 8:10 8:20 8:30 8:40 8:50 9:00 9:10 9:20 9:30 9:40 9:50 10:00

MONDAY

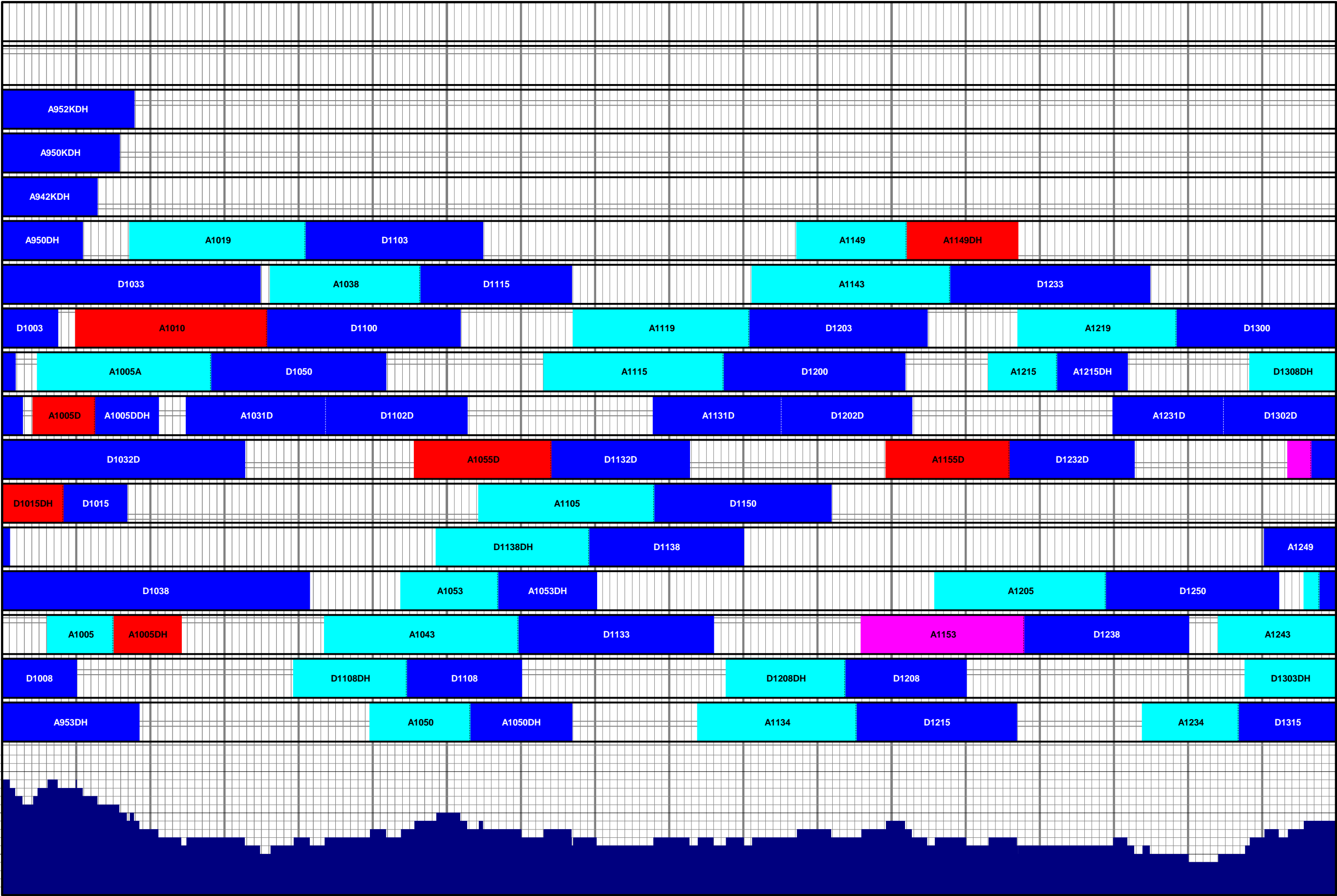
4-King-Caltrain1
4-King-Caltrain2
4-King-Caltrain3
4-King-Caltrain4
4-King-Caltrain5
4-King-CHST1
4-King-CHST2
4-King-CHST3
4-King-CHST4
Beale-Caltrain1
Beale-Caltrain2
Beale-CHST1
Beale-CHST2
Beale-CHST3
Beale-CHST4
Beale-CHST5
Beale-CHST6

17
15
13
11
9
7
5
3
1

Train count

10:00 10:10 10:20 10:30 10:40 10:50 11:00 11:10 11:20 11:30 11:40 11:50 12:00 12:10 12:20 12:30 12:40 12:50 13:00

MONDAY



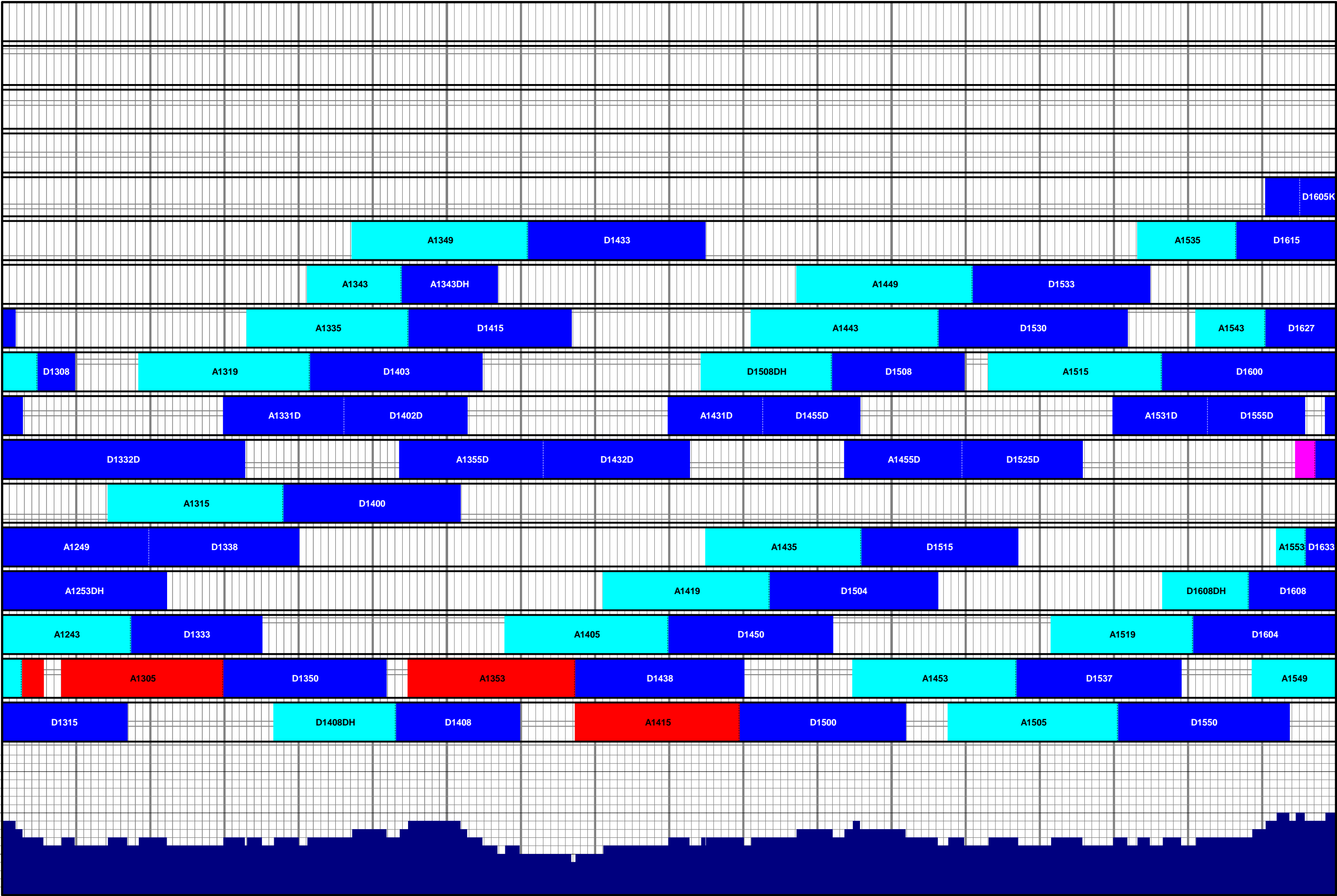
4-King-Caltrain1
4-King-Caltrain2
4-King-Caltrain3
4-King-Caltrain4
4-King-Caltrain5
4-King-CHST1
4-King-CHST2
4-King-CHST3
4-King-CHST4
Beale-Caltrain1
Beale-Caltrain2
Beale-CHST1
Beale-CHST2
Beale-CHST3
Beale-CHST4
Beale-CHST5
Beale-CHST6

17
15
13
11
9
7
5
3
1

Train count

13:00 13:10 13:20 13:30 13:40 13:50 14:00 14:10 14:20 14:30 14:40 14:50 15:00 15:10 15:20 15:30 15:40 15:50 16:00

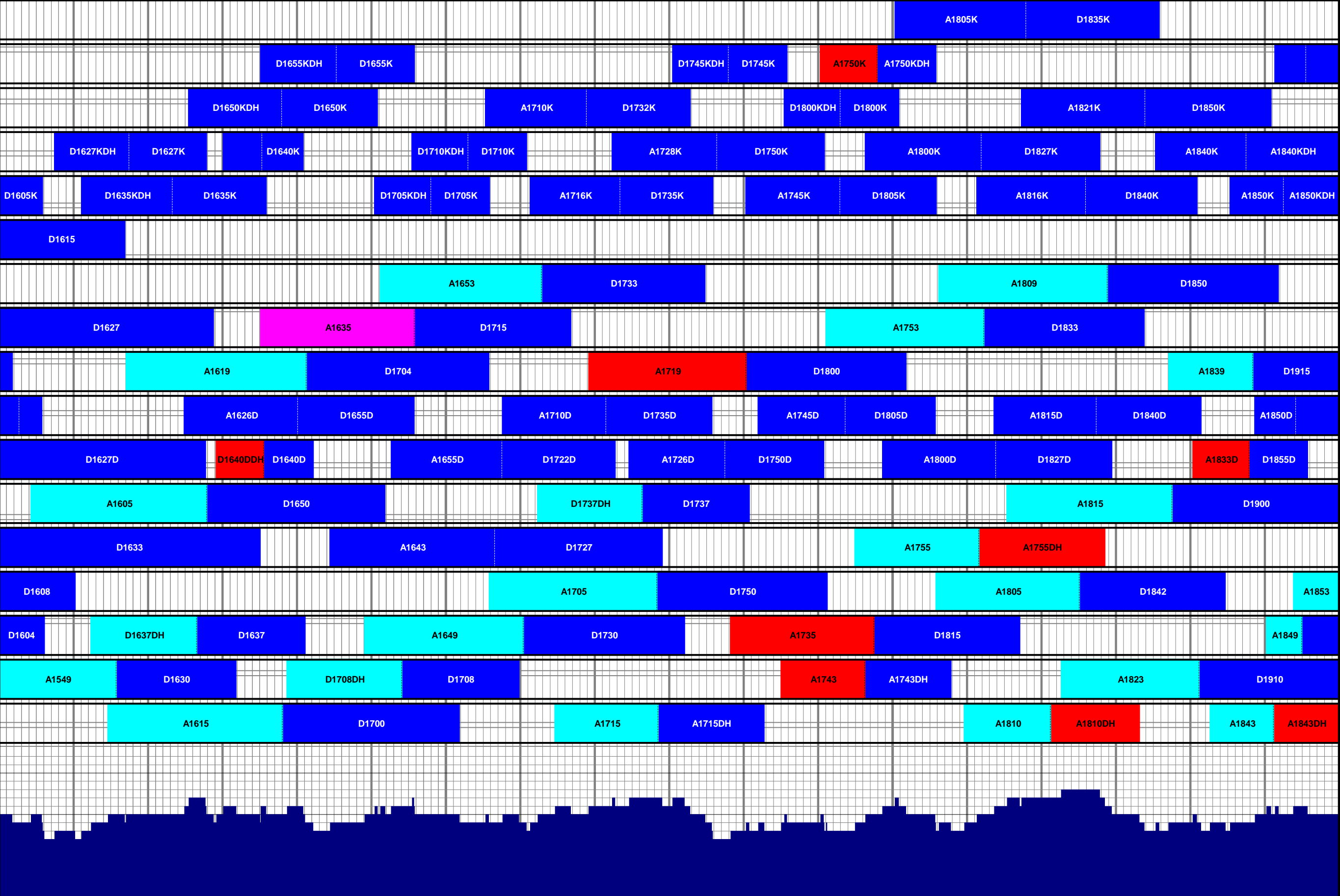
MONDAY



4-King-Caltrain1
4-King-Caltrain2
4-King-Caltrain3
4-King-Caltrain4
4-King-Caltrain5
4-King-CHST1
4-King-CHST2
4-King-CHST3
4-King-CHST4
Beale-Caltrain1
Beale-Caltrain2
Beale-CHST1
Beale-CHST2
Beale-CHST3
Beale-CHST4
Beale-CHST5
Beale-CHST6

Train count

17
15
13
11
9
7
5
3
1



16:00 16:10 16:20 16:30 16:40 16:50 17:00 17:10 17:20 17:30 17:40 17:50 18:00 18:10 18:20 18:30 18:40 18:50 19:00

MONDAY

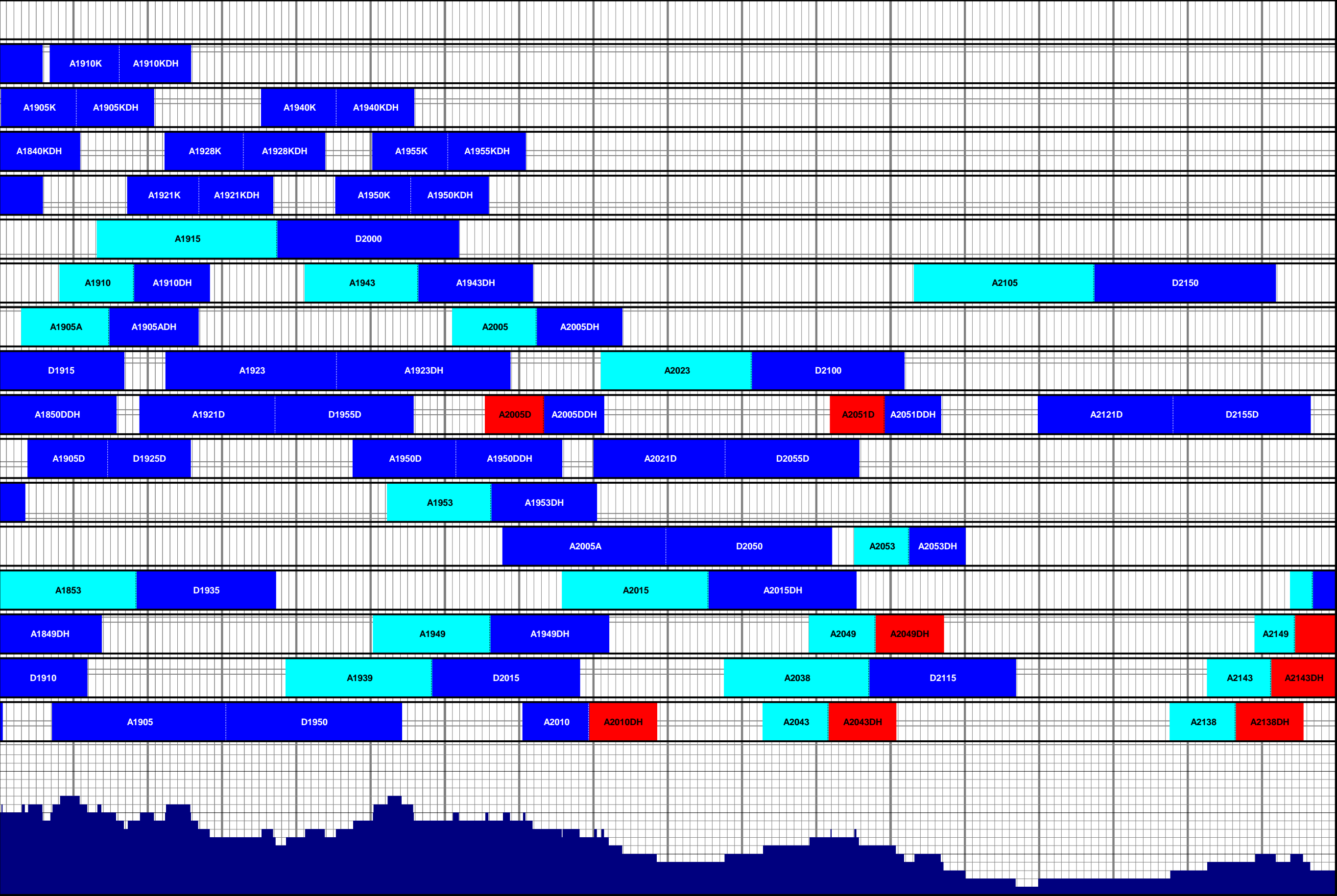
4-King-Caltrain1
4-King-Caltrain2
4-King-Caltrain3
4-King-Caltrain4
4-King-Caltrain5
4-King-CHST1
4-King-CHST2
4-King-CHST3
4-King-CHST4
Beale-Caltrain1
Beale-Caltrain2
Beale-CHST1
Beale-CHST2
Beale-CHST3
Beale-CHST4
Beale-CHST5
Beale-CHST6

Train count

17
15
13
11
9
7
5
3
1

19:00 19:10 19:20 19:30 19:40 19:50 20:00 20:10 20:20 20:30 20:40 20:50 21:00 21:10 21:20 21:30 21:40 21:50 22:00

MONDAY



4-King-Caltrain1

4-King-Caltrain2

4-King-Caltrain3

4-King-Caltrain4

4-King-Caltrain5

4-King-CHST1

4-King-CHST2

4-King-CHST3

4-King-CHST4

Beale-Caltrain1

Beale-Caltrain2

Beale-CHST1

Beale-CHST2

Beale-CHST3

Beale-CHST4

Beale-CHST5

Beale-CHST6

17

15

13

11

9

7

5

3

1

Train count

22:00

22:10

22:20

22:30

22:40

22:50

23:00

23:10

23:20

23:30

23:40

23:50

0:00

0:10

0:20

0:30

0:40

0:50

1:00

MONDAY

TUESDAY